

The Future of Electrical Power in the Republic of Kazakhstan

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Kazakhstan is rich in all forms of energy. With current production rates, the country not only can be self-sufficient in energy for the foreseeable future, but also may be able to export substantial amounts. The Republic of Kazakhstan, which covers some 1.8 percent of the land surface of the earth, enjoys roughly one half percent of the world's proven reserves of mineral fuels, or 30 billion tons. Of this, 80 percent is coal, 13 percent is oil and gas condensates and 7 percent is natural and secondary gas.¹ These resources are distributed unevenly across the Republic, as displayed in Figure 14–1. The coal deposits, for the most part, are concentrated in Northern and Central Kazakhstan. These same regions have rich deposits of minerals, which provide raw materials for Kazakhstan's industry. Here also are located the main sources of electrical energy. Western Kazakhstan is very rich in hydrocarbon reserves, while at the same time being poor in electrical power. Southern Kazakhstan does not have sufficient primary energy sources, and those found are inaccessible or as yet unexploited. The anticipated scale of hydrocarbon extraction in Southern Kazakhstan hardly can cover the region's need for electrical energy in the future. At the same time, however, this region possesses great hydroelectric potential.

The primary goals of the electrical energy sector for power generation on the domestic market and production for export are:

- To provide the country with energy security, which includes:
 - ◆ access or access rights to energy markets;
 - ◆ quality control and an uncompromising adherence to established standards;

- ◆ fair pricing that helps create reserves for development while taking into consideration social factors and line losses;
- ◆ ecological responsibility.
- Optimization of the fuel regimen of electrical stations, with an emphasis on gas wherever possible and economically acceptable, and the use of fossil fuel secondary gas;
- Utilization of international experience to mitigate the ecological side effects of coal, Kazakhstan's basic energy resource;
- Restoration of electricity production at existing electric installations, through their rehabilitation or reconstruction, whichever is the least expensive and quickest;
- Maintaining the designed capacity of electrical stations through the timely replacement of equipment that has outlived its designed service period, with new generation equipment;
- Construction of new electrical generation capacity to replace that going off-line, while meeting increased demand for electricity.

In 1990 Kazakhstan's electrical power plants produced 87.4 billion kilowatt hours (kWh) of electrical power.² Of this, thermal power plants accounted for 91 percent, hydro 8.4 percent, and nuclear 0.6 percent. In subsequent years, owing to the completion of projects that had been under construction, a number of new plants were brought on line at Ekibastuz-2 District Electrical Plant, the Karaganda-3 Thermal Power Plant, and the Aktube Thermal Power Plant (Akturbo). This has brought total electrical power generation capacity up to 95 billion kWh.³ Thus, electrical power generation in Kazakhstan is characterized by efforts to achieve self-sufficiency in electrical power and provide the necessary infrastructure for generating capacity with appropriate increases in reserve capacity for future needs. The realization of these tasks will allow Kazakhstan to trade energy profitably with its neighbors, and ensure a competitive electricity market.

For the purpose of examining the issue of power generation, Kazakhstan can be divided into three basic regions: Southern, Northern, and Western. Each of these regions will be discussed in the following sections, with emphasis on the amount of energy produced and the issues surrounding this production.

The Southern Region

The Southern Region consists of Almaty, Jambyl, Kzyl-Orda, the South Kazakhstan oblasts, and the City of Almaty. This region comprises roughly 38 percent of the country's population, and its growth has always been above the average for the Republic. Industry here consists primarily of the energy-intensive chemical production sector (which in 1990 accounted for more than 40 percent of electricity consumption in the region), as well as metallurgy, machine-building, light industry, and other enterprises. In addition, a significant part of the railway system has been converted to use electricity. This zone has a favorable climate with fertile arable land that has allowed the region to develop a highly productive agriculture and agricultural processing sector.

Demand for electricity in this zone in 1990 reached 26.43 billion kWh,⁴ while producing only 16.27 billion kWh,⁵ with the shortfall being delivered from electrical power plants of the Central Asian Unified Energy System.⁶ In light of the region's deficiency in primary energy resources, electricity production is based on outside coal, imported natural gas, and, in part, on locally produced fuel oil from petrochemical processing plants. The southeastern part of the region is potentially rich in hydro-electrical resources, yet only an insignificant part is utilized. It may be exploited in the future.⁷ In order to connect to the energy systems of other Central Asian countries, a power grid was built with 500 and 220 kV overhead transmission lines and a throughput capacity of more than 10 billion kWh per year.⁸ Thus, a very good material base is in place for subsequent cooperation with neighboring states as well as Kazakhstan's participation in the Central Asian energy market.

At present, the largest electrical plant in the southern part of the country, the Jambyl District Electrical Plant, which has a design capacity of 230 megawatts using fuel, gas and fuel oil, is practically idle. The under-utilization of this station is the result of the non-competitiveness of the electricity it produces on Kazakhstan's wholesale electrical energy market, which, in turn, is affected by increases in the price of gas and fuel oil on the international market. The stoppage of the Jambyl Plant has led to the creation of a palpable deficit in electricity, especially in the fall and winter seasons. At present, the shortfall is being covered by transferring electrical power from the Northern region of Kazakhstan (3.0 to 3.5 billion kWh per year) and importing power from other Central Asian countries. It is worth noting that in the Fall-Winter season of 2001-2002, the Government of the Republic of Kazakhstan appropriated a subsidy grant from the Republic

budget to acquire fuel for the Jambyl District Electrical Plant, in an effort to make its electrical production competitive.

Domestic sufficiency and even, in the long run, export potential in this region of traditional shortfalls could be achieved, both through the reconstruction and reequipping of existing thermal power facilities, as well as through new construction. As the Southern region experiences sharp shortfalls in peak load regulating capacity, priority must be given to new construction. According to official government sources, this can be achieved through:⁹

- Installing a second 500 kilovolt (kV) North to South Kazakhstan transmission line, for a total throughput capacity (two 500 kV and one 220 kV) of 6 to 7 billion kWh of electrical energy per year;¹⁰
- Constructing the planned Mainak Hydroelectric Station on the Charyn river with a capacity of 300 megawatts (0.7 billion kWh);¹¹
- Building the Kerbulak Hydroelectric Station on the Ili River with a capacity of 50 megawatts (0.3 billion kWh);
- Building a co-generation plant of 100 to 200 megawatts capacity, using secondary gas recovered from petroleum processing at the Kumkol fields (0.6 to 1.3 billion kWh);¹²
- The creation of mini hydroelectric stations along mountain rivers, with an overall output of 500 to 600 megawatts (2.0 to 2.5 billion kWh);
- Completion of wind energy projects, with a capacity of 500 to 600 megawatts (1.2 to 1.5 billion kWh).¹³

The Southern Kazakhstan zone shares borders with several other Central Asian countries. Preliminary analysis suggests significant shortfalls in electrical power will occur in this area in the future. The risk of energy surplus is less than the risk of shortfalls, as any overproduction of electricity in Southern and Northern Kazakhstan could be offered to the Central Asian energy market. Supply can be provided through the existing network of electrical 220 and 500 kV transmission lines between Kazakhstan and Uzbekistan and between Kazakhstan and Kyrgyzstan, which have an overall transmission capacity of no less than 10 billion kWh per year.

The Northern Region

The Northern Region consists of East-Kazakhstan, Pavlodar, Karaganda, Akmola, North-Kazakhstan, and the Kostanai oblasts. This region

possesses ample cheap and accessible fuel resources, and has a well developed energy production sector. The country's primary coal regions are located in this area: Ekibastuz, Karaganda, Maikuben, Turgai, and others. Coal mined from these deposits is used at all the thermal power plants of the southern and northern regions of Kazakhstan, and is exported to Russia as well. Electrical power generation in the Northern Region of Kazakhstan also includes very powerful hydroelectric stations located in the East-Kazakhstan Oblast, which has very high hydro electrical potential.

In the Northern Region of Kazakhstan, it would be possible to increase the output of electrical power to meet not only local demand and transmission to the south of Kazakhstan at the necessary levels, but also for export to the Central Asian countries and Russia. Currently, the electrical power produced in the Northern Region is transmitted to the south of Kazakhstan along a 500 and a 220 kV North-South Kazakhstan overhead line. A small portion (300 to 400 megawatts) is exported to the Siberian regions of Russia.¹⁴

In all potential scenarios, demand in the Northern Region, including transmission to the south of Kazakhstan, as well as export to Russia and Central Asia, can be met through reconstruction as well as by re-equipping and increasing capacity at existing electrical generation facilities. With minimal investment, this would transform the zone into a net supplier of energy with a significant (10 to 15 billion kWh) surplus production.¹⁵

The Western Region

The Western Region of Kazakhstan, in energy terms, is comprised of three regions and energy systems: the Atyrau-Mangistau (Atyrau and Mangistau Oblasts), Aktyube Oblast, and the West-Kazakhstan Oblast. The Atyrau-Mangistau system is self-sufficient and has surplus production of more than 800 megawatts. Aktyube and West-Kazakhstan Oblasts are net consumers of energy. Demand for electricity, 1.2 and 0.5 billion kWh, respectively, is covered through import from the border regions of Russia.

Since the Caspian coastal zone is rapidly developing its oil and gas sector, including the exploitation of the Caspian Shelf, the creation of elaborate oil pipelines will increase significantly the demand for electrical power. According to growth estimates and the pace of implementation of the oil and gas production program to 2015, it will be necessary to increase energy production capacity by 2,000 to 3,000 megawatts. The fuel resources in the region make it possible to meet this demand and even create an export capacity in electric power.

Current production capacity in Atyrau-Mangistau can fully satisfy demand in Mangistau Oblast in the short to medium term, since the capacity of the electrical plants of Aktau is 1350 megawatts, while current demand does not exceed 500 megawatts. Although there is a surplus at the present time, the Mangistau utility cannot be transferred completely to the Atyrau oblast because of the limited electrical capacity of the interconnecting lines.¹⁶

The intense growth of the oil and gas sector in Atyrau Oblast demands the construction of new electrical power generation capacity, using steam and pipeline cogeneration technologies. By 2015 new capacity likely will be needed. It is anticipated that no less than 14 billion kilowatts per hour of electrical energy will be needed for production on the offshore oil platforms of the Caspian Sea.¹⁷ Since the increased demand for electricity in Atyrau Oblast is tied to the growth in oil production, the growth of energy capacity can be realized by the building of electrical plants and by the oil companies developing the oil and gas deposits of the region. For example, the TengizChevroil Company, which already has a pipeline cogeneration plant with a 144- megawatt capacity, has built new gas-fired turbines for a 120-megawatt electrical station. A portion of this facility is currently operational, and full production capacity should be reached by 2005.

The energy resources of Atyrau Oblast, in the form of secondary gas from the oil industry, will not only cover local demand but will also make it possible to create a large electricity export capacity. In the medium to long term, there is a proposal to create a high voltage, high capacity electrical network to transmit Atyrau electricity to Aktyube and the West-Kazakhstan Oblasts, and on to the northern regions of Kazakhstan, as well as to Russia and other countries.

In order to make Aktyube Oblast self-sufficient, new generating capacity is needed. The planned doubling of oil production in the Oblast could increase secondary gas production by some 600 to 700 million cubic meters, which is sufficient for the construction of a cogeneration plant with a 250 to 300 megawatt capacity and production of more than 2 billion kWh per year.¹⁸

In the West-Kazakhstan Oblast, it would be possible to construct natural gas pipeline cogeneration plants, especially at the Kapchagai condensed gas deposits, where a cogeneration plant with a 240-megawatt capacity is already under construction.¹⁹ In light of the planned exploitation of a group of oil and gas deposits in the immediate vicinity of Uralsk, and the corresponding release of large volumes of secondary gas, electrical

power generation will increase sharply. These gas resources translate into potential electricity production of more than 80 billion kWh. This gas would suffice to cover the demand for electrical power in the region for some 30 to 40 years at current levels of demand.²⁰

In addition to creating electrical connections between Atyrau, Aktyube, and Uralsk, plans are under review to construct a 500 kV overland transmission line between Aktyube (Ul'ke) and Zhitigora across the breadth of Kazakhstan. The realization of this 500 kV line project across Western Kazakhstan would make it possible to unite the energy network of this region with the Unified Energy System (UES) of Kazakhstan.

Patterns of Demand: Past and Future

Kazakhstan's primary electrical energy production relies on cheap Ekibastuz coal. It should be noted that the highest production levels of electricity in Kazakhstan were reached in 1989, when it produced 88.9 billion kWh.²¹ In spite of the aging of large portions of the existing plants, Kazakhstan's electrical power plants at present have a known capacity potential which can fully cover domestic demands as well as create an export potential. Nonetheless, due to peculiarities within the network, southern and western Kazakhstan, as noted above, import electrical power.

The period between 1990 and 1999 in Kazakhstan was characterized by a drop in both demand and supply of electricity. In 1990, demand for electricity was 104.72 billion kWh and production was 87.38 billion kWh. In 1999, the numbers were 50.74 billion kWh and 47.47 billion kWh respectively, while in 2000, these numbers reached 54.38 billion kWh and 51.42 billion kWh.²² The installed capacity of Kazakhstan's electricity plants on January 1, 2001 was 18,100 megawatts with a usable capacity of 13,416 megawatts. Table 14-1 summarizes the basic data of energy production for the decade. Tables 14-2 and 14-3 show installed capacity and electricity production.

Table 14-1. General Characteristics, 1990-2000

Item	Units	1990	1995	2000
Demand	Billion kWh	104.7	74.38	54.38
Per Capita Demand	kWh	6,236	4,480	3,664
Installed Capacity	Megawatts	17,570	18,420	18,100
Supply	Billion kWh	87.4	66.98	51.42
Balance (Imports)	Billion kWh	17.34	7.4	2.96

Table 14–2. The Structure of Installed Capacity (Jan 1, 2001)

Type	Megawatts	Percent
Thermal, Steam Pipeline, and Organic Fuel	15,541	85.9
Gas Pipeline	332	1.8
Hydraulic	2,228	12.3
Total	18,101	100

Table 14–3. The Structure of Electricity Production (Jan 1, 2001)

Type	2000		2001	
	Billion kWh	Percent	Billion kWh	Percent
Coal-Burning Thermal	37.3	72.5	40.52	73
Fuel-Oil and Gas-Burning	6.61	13	6.66	12
Hydro	7.51	14.5	8.06	15
Total	51.42	100	55.24	100

Table 14–4 provides the electricity balances (demand and production) by region and for the Republic for the past decade, and estimates to 2005 and 2010.²³ As is clear from Table 14-4, the economic crisis of the transition period in Kazakhstan led to a significant drop in electricity demand. It is assumed that the country's economic reform policies will lead to a gradual recovery from this crisis, a subsequent resurgence of demand for electricity, and eventual growth past old levels. According to the *Kazakhstan 2030* Program,²⁴ the 1990 level of electricity demand (104.7 billion kWh) will be reached even in the worst-case scenario by 2030, and in the best-case scenario, by 2020.²⁵ The pace of electricity production will depend on the development of the overall economy of Kazakhstan.

It is important to note that Kazakhstan is no longer a centralized command economy and is moving in the direction of a free market. Since 1995, significant market reforms and transformations have been carried out. During this period, privatization of the most important enterprises in different branches of the economy was begun, including in such strategic sectors as electrical power and ferrous and precious metallurgy. This transformation will have a significant effect on the energy sector's ability to meet the country's future needs.

Table 14–4. **Regional and Republican Electricity Balances to 2010**
(Billions kWh)

	1990	1992	1994	1998	2000	2001	2005	2010
Electricity Demand								
Total	104.72	96.87	79.43	53.40	54.38	56.66	59.00	72.00
North	66.42	64.01	53.73	37.04	37.92	39.11	40.00	48.00
South	26.43	21.63	16.45	9.70	9.49	10.13	11.00	14.00
West	11.87	11.23	9.25	6.66	6.97	7.42	8.00	10.00
Electricity Supply								
Total	87.38	82.86	66.40	49.59	51.42	55.24	59.00	72.00
North	63.89	61.27	52.04	37.42	40.43	44.02	41.90	49.80
South	16.27	14.77	9.20	7.40	5.82	5.60	9.10	12.20
West	7.22	6.82	5.16	4.77	5.17	5.62	8.00	10.00
Balance								
Total	(17.34)	(14.01)	(13.03)	(3.81)	(2.96)	(1.42)	0.00	0.00
North	(2.53)	(2.74)	(1.69)	0.38	2.51	4.91	1.90	1.80
South	(10.16)	(6.86)	(7.25)	(2.30)	(3.67)	(4.53)	(1.90)	(1.80)
West	(4.65)	(4.41)	(4.09)	(1.89)	(1.80)	(1.80)	0.00	0.00

Transformation of the Electricity Sector

Substantial transformation already has taken place in the electrical power sector of the country. It is important to note that the reconstruction and reorganization of the electricity sector started much later than did other sectors of the economy of Kazakhstan.²⁶ Yet, at this point, the level of implemented market reforms in the electricity sector of Kazakhstan is far ahead of other Commonwealth of Independent States (CIS) countries. The organizational structure of Kazakhstan's energy sector has undergone significant change since the country became independent, and this reorganization itself has gone through several stages.²⁷

Stage One

Stage One was the separation of the state regulatory systems from the economic functions of the industry. In February 1992, the Ministry of Energy was reorganized into the Ministry of Energy and Fuel Resources, with responsibility for regulating these branches of the energy sector.

Operations were transferred to the newly created vertically integrated State Electrical Energy Company *KazakhstanEnergo*, which was charged with the production, transmission, distribution, and sale of electricity and heat, as well as the centralized financial management of its constituent Territorial Energy and Electrification Utilities. The company also took control of the departments of planning, construction, installation, maintenance, and repair of electrical plants, and the heating and electrical networks. The creation of this company coincided with the liberalization of prices on goods and services in the larger economy, but excluded subsidized prices on energy.

Stage Two

Stage Two started in 1995, when the sector was broken up through a decree of the Government of the Republic of Kazakhstan that created a Republican-level State-owned Enterprise called “*KazakhstanEnergo* National Energy System.” This enterprise was based on existing intersystem electrical transmission lines, the Republic’s largest electrical power plants (as subsidiaries), and nine “Territorial Energy Systems,” which also were to be State-owned. The design, research and development (R&D), construction, installation, and repair organizations were reorganized as independent contractors.

Stage Three

Stage Three of the reorganization of the electricity sector began in 1996. The Government of the Republic of Kazakhstan issued a decree on the need to reform the state monopoly of generation and distribution of electric power, which created the prerequisites for the development of a competitive electricity market. To this end, a privatization and restructuring program was developed for the electricity sector, adopted by Government Decree Number 663 in May 1996.²⁸ The basic idea of this program was a fundamental change in the form of ownership of generation plants in the electricity sector.

Stage Four

Stage Four was set into motion when Decree Number 1188, adopted in September 1996, created the Kazakhstani Electricity Management Company *KEGOC*, from the transmission and distribution assets of *KazakhstanEnergo* along with the transmission lines previously belonging to the territorial energy utilities and eighteen joint-stock electrical distribution companies. As a result of this stage, the basics of a market in electri-

cal energy and capacity emerged, based on mutual agreements between sellers and consumers of electrical energy, as well as between consumers and electricity distributors.²⁹ Most important, the price of electricity was determined by the market and set by the producers themselves.

Stage Five

Stage Five occurred when the Government adopted a program for the further development of the electricity market during the 1997 to 2000 period, which improved the initial model of a competitive electricity market that had been operating up to that time.³⁰

In this way, the reorganization of the electrical power sector of Kazakhstan, and particularly the privatization program and sector reorganization, has:

- Separated the competitive sector of the electricity industry (production and consumption) from the naturally monopolistic sectors (transmission and distribution);
- Realized the large-scale privatization of generating capacity:
 - ◆ The powerful electrical plants of “national importance” (national importance means electrical plants that are essential for the economy of the country), which are located in the immediate proximity of the main deposits of cheap coal (Ekibastuz) have been privatized;
 - ◆ High-capacity hydroelectric stations, used for regulating the grid load of the Unified Energy System (UES) of Kazakhstan, have remained the property of the State, and are managed as concessions;
 - ◆ Industrial electrical plants, which supply electrical energy to major industrial enterprises, have been transferred to these industrial enterprises;
 - ◆ Regional-level district thermal-electric systems—a source of both heat and electrical energy—have, for the most part, been privatized along with the regional electric distribution companies. The remaining systems have been transferred to municipal ownership.
- Accomplished de-statization of the electrical network through the creation of:

- ◆ A joint-stock company “Kazakhstan Electricity Network Company” (*KEGOC*) on the basis of the main high-tension networks of 1150, 500, and 220 kV;
- ◆ Joint-stock distribution companies, on the basis of regional electrical networks of 110-135 kV and local networks of 6-10 and 0.4 kV.

Structures that are defined as “natural monopolies of the electrical sector” come under the control of the State (within the Ministry of Energy and Mineral Resources). Tariffs for electrical transmission and distribution services are regulated by the Republic of Kazakhstan Agency for Regulation of Natural Monopolies, Fair Competition, and Small Business.

Conclusion

The wholesale electricity market in Kazakhstan accounts for about 60 percent of consumption, which has allowed the decrease of tariffs on electrical power within the country.³¹ At present, the Government of Kazakhstan is discussing the concept of organization of the electrical power and services retail market. The development of a retail market for electrical power is a serious step in preparation for joining the World Trade Organization. Another problem under consideration is related to the price parity between the regions and inside of each network company. Also, there are questions related to the effective organization of electrical power retail trading.

In the Government’s view, it is necessary to separate the selling of goods (electricity) from services (provision of electricity) in retail trading. Thus, regional electricity companies (RECs) will purchase electricity from traders on the wholesale market, and then sell it to final consumers. The Government Anti-Monopoly Committee will regulate REC services, and the trading will be competitive. It also is suggested that selling electrical power be accomplished using electronic-commerce methods, which would offer consumers the opportunity to choose their source of power.

The sale of electrical power to large-scale customers also has been suggested. In this case, factories and plants able to purchase 500 and more kWh in one transaction time may buy directly from a producing electric company. Minor consumers can form groups and jointly participate in such trading as well. Energy experts in the country support the concept of retail market formation; however, a pilot project will be required before it is introduced to the whole economy. The retail market is scheduled to start at the end of 2004.

The successful realization of the government's program for reorganization of the electrical power sector of the economy, including State monitoring of the development of the sector and the relationship between market actors, will make it possible to ensure the energy security of Kazakhstan, the reliability of the electrical supply, the reconstruction and restarting of existing electrical plants and the construction of new sources of energy.

Editor's Note

The electricity sector in Kazakhstan is deeply intertwined with regional water issues. See Daene McKinney's chapter in this volume for a discussion of the importance of the regional electricity grid in resolving transboundary water disputes. The tendency to focus on supply-side issues in energy is quite common among energy scholars in the region. International Financial Institutions, however, have tended to focus on improving transmission and management. Future demand remains difficult to predict, since it depends on the evolution of the economy: The structure of industrial development in Kazakhstan will determine its energy needs. Predicting demand is further complicated by the fact that Kazakhstan, although it has improved collections rates dramatically, still does not recover the full price of electricity. Economists focus on "effective demand," that is, demand among those who can pay full price. In Kazakhstan, the levels of "effective demand" remain unclear.

Notes

¹ *Kazakhstan's Energy: Movement to the Market*, (Russian language) (Almaty: Galim Publishing House, 1998), 582.

² GoK, *Program of Development of Electric Energy to the Year 2030* confirmed by resolution of the Government of the Republic of Kazakhstan on April 9, 1999, no. 384, 2.

³ *Ibid.*, 3.

⁴ *Ibid.*

⁵ *Kazakhstan's Energy*, 582, table 2.6.1.

⁶ The Unified Energy System was the all-Soviet system, which integrated Central Asia into a single electricity grid.

⁷ K.D. Dukenbayev, E.G. Ulriks, and G.A. Papafansopulo, "Volume of the Market for Electric Energy and Demand for Investment in Energy," *Energy and Heat Resources of Kazakhstan*, 2002, no. 8, 4-12.

⁸ *Ibid.*, 5.

⁹ GoK, *Program of Development of Electric Energy to the Year 2030*,

¹⁰ K.A. Bozumbaev, "Five Years of Work of the National Company OAO 'KEGOC,'" in *Energy and Heat Resources of Kazakhstan*, 2002, no. 9, 5, 11, and 25-26.

¹¹ GoK, *Program of Development of Electric Energy to the Year 2030*, 5, 11, and 14.

¹² *Ibid.*, 5, 11, and 14.

¹³ *Ibid.*, 14.

¹⁴ V.M. Barsukov and A.A. Zeibel, "Account of Electricity Output of Kazakhstan in 2002," *Energy and Heat Resources of Kazakhstan*, 2003, no. 10, 5-19.

¹⁵ GoK, *Program of Development of Electric Energy to the Year 2030*

¹⁶ K.D. Dukenbayev, E.G. Ulriks, and G.A. Papafansopulo, "Volume of the Market for Electric Energy and Demand for Investment in Energy," *Energy and Heat Resources of Kazakhstan*, 2002, no. 8, 64.

¹⁷ *Ibid.*, 6.

¹⁸ *Ibid.*, 4-12.

¹⁹ *Ibid.*, 12.

²⁰ *Ibid.*, 7.

²¹ *Kazakhstan's Energy*, 99.

²² V.M. Barsukov and A.A. Zeibel, no. 6, 10-25.

²³ Maximal scenarios in 2005 and 2010 are taken from the Ministry of Energy's *Kazakhstan 2030 Electricity Development Program*.

²⁴ Plan 2030 for Kazakhstan, adopted as Government policy in 1998, set out the long-term goals of development for Kazakhstan.

²⁵ GoK, *Program of Development of Electric Energy to the Year 2030*, 12.

²⁶ Depending on the process of privatization in the energy sector.

²⁷ *Kazakhstan's Energy*, 4.

²⁸ GoK, *Program of Privatization and Restructuring in Electrical Energy*, Decree of the Government of the Republic of Kazakhstan, no. 663, May 30, 1996.

²⁹ GoK, *Concerning Several Measures for Restructuring of the Regulatory System for Electrical Energy in Kazakhstan*, Decree of the Government of the Republic of Kazakhstan, no. 1188, September 28, 1996.

³⁰ GoK, *Concerning Additional Measures for Fulfillment of the Program of Privatization and Restructuring of the Electrical Energy and Long-Term Reform of the Electricity Market*, Order of the Government of the Republic of Kazakhstan, no. 1193, July 31, 1997.

³¹ Tulegen Izdibaev, "Government Develops Concept for Organization of Differentiated Markets for Electrical Energy and Services," *Panorama*, October 2003, no. 39.