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KEY ISSUES IN POWER CONTRACTING AND PRICING

NIS Institutional Based Services Under the Energy Efficiency and Market Reform Project
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CAR Regional Energy Trade,
Electricity Contracting and Pricing Reform
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Final Report

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Subject Analysis of Key Issues - Electricity Contracting and Pricing in Central Asia

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Present status of electricity trade

The interconnection of power systems in Central Asia was begun in 1960, and resulted in the formation of the Central Asia Integrated Power System This system is now owned by five countries but it continues to operate at a single frequency because it is interconnected The frequency is commonly below 50 Hz, and appears to fluctuate around 49 5, actual line voltages are sometimes below the design voltage (e g actual 200 kV instead of design 220 kV) The transmission system is designed to shed load automatically at 49 2 Hz and such outages have occurred Installed generating capacity is around 25 GWe (we do not have an exact figure, it was 21 9 GWe in 1985), and therefore the capacity of the system is roughly comparable to the Polish power grid, spread over a larger geographic area

Power generation in Kazakhstan is predominantly coal-fired In Uzbekistan and Turkmenistan it is predominantly gas-fired In Kyrgyzstan and Tajikistan it is predominantly hydroelectric The hydroelectric resources of these two countries are needed to provide spinning reserve and to stabilize voltage and frequency in the power grid of the other three countries In the Central Asia power grid as a whole, 63 percent of the installed capacity is thermal (fossil fuel) and 37 percent is hydroelectric

Each country has a vertically integrated generation, transmission, and distribution enterprise that procures fossil fuel and keeps its fuel cost and fuel purchase agreements confidential Each country has a dispatch center for operation of distribution lines (voltages below 220 kV) All five countries signed an agreement in 1991 to continue parallel operation of the high-voltage grid, i e , to remain interconnected The prices of electricity in international trade in Central Asia are between 4 and 5 cents/kWh Despite the difference in cost between hydro and thermal generation there are no time-of use prices within a one-month period, and there is no metering equipment suitable for time-of-use pricing in international trade The amount of electricity to be imported or exported is adjusted monthly according to purchase contracts These monthly amounts are given to the United Dispatch Center, which is responsible for ensuring that in each month the net delivery of power from each country to each other country is consistent with the power sales contracts Generating units are dispatched without a knowledge of fuel costs, but there is a dispatch order that is approximately based on a ranking of energy sources (hydro, gas, coal, oil) according to the variable cost of generation in different countries

There is no agreement on the management of water resources for irrigation There is no system of ownership of water rights None of the downstream countries is willing to pay an upstream country for water rights There is no procedure for computing the economic value of water, for use in setting target reservoir levels or determining the economic dispatch of hydro stations

In general none of the countries in Central Asia can afford to pay any other country for electric power, and none of the countries is able to finance major capital construction projects in power generation Kyrgyzstan and Tajikistan are maximizing the use of hydropower to attain electricity "independence " They are disregarding past Soviet guidelines for storing water in wet years to cover potential shortages in dry years

The power exporters are Turkmenistan, Kyrgyzstan, and Tajikistan They exported electricity in 1992 and hope to export much more in the future However, none of the Central Asian countries wants to be an importer of electricity Russia is not a likely market because Russia has access to low-cost hydropower from western Siberia Kazakhstan exports crude oil and coal but imports electricity, it may be able to stop importing electricity but it would have difficulty finding a way to export it, except perhaps to China There are proposals to export electricity from Turkmenistan to Turkey (via Iran), from Turkmenistan or (more realistically) eastern Tajikistan to Pakistan (via Afghanistan), and from Kyrgyzstan to China

The high-voltage grid of Central Asia consists of 220 kV and 500 kV lines There are no lines operating at 330 kV, 750 kV or 1100 kV The high-voltage grid was built without regard to energy independence of the various republics New transmission lines are planned, and they all have the effect of making the countries more independent of each other

> *South Kazakhstan* is divided into two regions east and west Kyrgyzstan separates the region west of Bishkek (including Chimkent and Dzhambul) from the region east of Bishkek (including Almaty) To move power between Chimkent and Almaty it is necessary to go through the 500 kV substation at Bishkek (which is still labeled Frunze on the latest United Dispatch Center map) A new 500 kV line from Dzhambul, Kazakhstan, to a substation west of Lake Balkhash is proposed, it will give south Kazakhstan an east-west link that does not transit through Kyrgyzstan
>
> *Kyrgyzstan* is divided into two regions north and south The northern 220 kV grid has a thermal power station and is connected with south Kazakhstan and with a 500 kV line to the Toktogul hydro station in central Kyrgyzstan The southern 220 kV grid has three hydro stations and is connected to the 220 kV grid in eastern Uzbekistan, Osh is served by a 220 kV line from Uzbekistan There is a north-south 500 kV line but it cannot receive power from the southern 220 kV grid except through a substation located in Uzbekistan It appears that a new 500 kV substation could be built within Kyrgyzstan, if necessary, to deliver power to Bishkek from the hydro stations downstream of Toktogul station, but this would not solve the problem of transmitting power to Osh A new 220 kV line would be needed to serve Osh without relying on Uzbekistan A new 220 kV line to China is proposed, and according to Kyrgyz officials it has already been completed as far as Naryn

Uzbekistan is divided into three regions center, east, and south The largest region serves the center of the country, including Bukhara, Samarkand, and Tashkent The Fergana Valley region in the east, including the cities of Andizhan and Kokand, has a 500 kV line that is connected with the rest of Uzbekistan only by a 500 kV line through Tajikistan A new 500 kV line within Uzbekistan is proposed, this would give the Fergana Valley a strong link with the rest of the country that would not rely on transit through Tajikistan The third region is the southern tip of Uzbekistan, which is served by a 500 kV line from a substation located in Tajikistan, near Dushanbe Again, a new 500 kV linking southern Uzbekistan with the rest of the country is proposed, to link the center and the south without transit through Tajikistan

Tajikistan is divided into two regions north and south The northern region has one hydro station and is connected to the Uzbekistan grid The southern region, which is much larger and includes Dushanbe, has three hydro stations and a thermal station There is no north-south connection within Tajikistan, and according to the United Dispatch Center no such link is planned for the period through 1997

Turkmenistan is divided into three regions center, north, and east The central region includes the major cities and accounts for most of the electricity consumption The northern region is connected to Uzbekistan and has no generating capability Power from Uzbekistan is imported at the equivalent of 5 U S cents/kWh A new 500 kV line is being built to connect northern Turkmenistan with the central grid, i e , the principal national grid, to increase the country's energy independence from Uzbekistan The eastern region is a small 220 KV grid in a sparsely populated area south of Bukhara, power in this region is imported from Uzbekistan There are no plans to connect the eastern 220 kV grid with the center

There are three neighboring countries connected to the Central Asian grid, and others may follow

1) *Russia* The southern Kazakstan thermal power station west of Lake Balkash is connected to the Agadir substation by a 500 kV line that can be used to import 400 MW of Siberian power from Russia to south Kazakhstan The 400 MW import capability is maintained as a reserve for emergency use

2) *Afghanistan* Two parallel 220 kV lines extend from the southern tip of Uzbekistan into Afghanistan Electricity trade is very limited

3) *China* An existing 10 kV line is used to export a small amount of power from Kyrgyzstan to China, and the two countries have signed an agreement to build a 220 kV line along the same corridor so that a larger amount of power can be exported

4) *Iran* Turkmenistan plans to construct a high-voltage power line to the Iranian border, a low-voltage connection already exists Iran does not represent a major export market for Turkmenistan's electricity, but it could wheel power to Turkey

5) *Turkey* may someday import power from Turkmenistan One long-term option considered by Turkmenistan is to export electricity to Turkey via Iran The director of the United Dispatch Center does not expect Iran to build an east-west line in the near future

6) *Pakistan* The Islamic Bank has funded a consulting firm from Turkey to assess Kyrgyzstan's export markets in China and Pakistan This firm has an office in the Kyrgyz National Energy Holding Company building If the Islamic Bank chooses to finance the line, exports to Pakistan are possible

Future patterns of electricity trade

Each country in Central Asia is interested in increasing its energy exports in some form and in reducing its imports of practically all forms of energy None of the countries has a very clear idea of the least-cost solution to the region's energy problems, and there is some sentiment that in a "market economy" each country is free to pursue aggressive marketing and bargaining tactics (preserving state monopolies in electricity generation and fossil fuel production, setting prohibitively expensive transit tariffs, threatening to cut off energy supplies to neighboring countries) rather than establish a competitive market that will achieve economically efficient patterns of trade In each country technical experts tend to believe that an impartial generation planning study will prove that the World Bank and other lenders should direct capital resources toward their favorite projects There is a keen interest in having a foreign donor provide a study that justifies investment in such projects

The presence of foreign investment in crude oil production and gold mining (and perhaps other forms of mining) has contributed to the perception that the Soviet era plans for further capacity expansion in the power sector can be realized with foreign capital There is no doubt that Kazakhstan has the oil resources to attract investment Energy exports other than crude oil are perceived to be something that foreigners will invest in, because the energy can be sold at "world prices " Therefore the preferred approach to energy trade is to attract investment in projects that will reduce energy imports and/or increase energy exports The idea of cooperation - of finding a way in which all five countries can make the best use of the energy sector assets they already have - is less appealing than energy independence backed by foreign investment

In this respect the conditions for regional cooperation are less favorable than in the Baltic countries In the Baltics there is practically no crude oil, natural gas, or coal production and no gold or precious metal reserves large enough to attract foreign investment The sharp increases in fossil fuel prices in 1992 resulted in a sharp drop in electricity demand, including export demand for Lithuanian electricity, that has caused the need for new generating capacity to be deferred and has facilitated the shutdown of one of the Ignalina units and eight of the older oil shale units at Narva There is a recognition that for the next few years, at least, very little new generating capacity will be brought on line in the Baltics In fact there is a concern that there will not be enough foreign investment to refurbish or replace the older generating capacity as it reaches the end of its design life

To plan a program in electricity contracting and pricing in Central Asia it would be helpful to know what kind of trade pattern is likely to develop in the future We suggest that the following scenarios be considered among the likely outcomes

1) Electricity independence In this scenario each Central Asian country reduces its electricity imports Electricity contracting and pricing is important in the short-term, but other types of contracts (for example, water agreements and gas transit) become higher priorities for the host countries

This scenario has the greatest appeal to policy-makers in the region Because Turkmenistan and Uzbekistan have strong one-party leadership, arguably this scenario is the most realistic In south Kazakhstan both economic and political factors may play a role Electricity independence could be achieved in south Kazakhstan, for example, by construction of new 500 kV lines, coal-fired capacity, gas-fired capacity, and small hydro projects This approach is consistent with the AID-funded planning project in south Kazakhstan

2) Development of gas-fired capacity In this scenario the high cost of capital in the region (in effect, the high discount rate) makes gas the least-cost option The winners are Turkmenistan and Uzbekistan and the losers are Kyrgyzstan and Tajikistan The question is whether to import gas or import electricity Seminars on contracting and pricing would be most effective if gas and electricity are both considered

It is well known that large natural gas reserves exist in Turkmenistan and Uzbekistan, that gas-fired combined cycle plants (CCTs) typically have a lower capital cost per kW than hydro projects, that CCTs can be built in relatively small capacity increments, and that capital is scarce in the region It is possible to convert an existing gas-fired boiler to a CCT by adding a gas turbine and converting the boiler to a heat recovery steam generator If gas is given a very low value - for example, in Turkmenistan, where there are no gas meters in the residential sector because gas is free - it is possible to minimize capital costs per kW by installing single-cycle combustion turbines (to be followed, perhaps, by heat recovery steam generators in a few years) Siemens is pursuing a gas CCT project in Kazakhstan and General Electric has been negotiating a contract to build gas-fired capacity in Turkmenistan

3) Mixed use of hydro resources This scenario supports the development of a combination of gas-fired and hydroelectric capacity, with the financing for hydro development made available on the basis of irrigation benefits and protection of the Aral Sea In this scenario the hydro development is made possible by the market for water, not the market for electricity Seminars on contracting and pricing would be most effective if electricity, gas, and water contracts are all considered

In the viewpoint of the director of the Dispatch Center in Tashkent, the most serious flaw in the present set of international contractual arrangements is the absence of an agreement on the use of water for irrigation There is a multilateral agreement on parallel operation that was signed in 1991, and there exist one-year contracts for electricity sales among countries

Interest in workshops on electricity contracting and pricing

All five countries are interested in receiving information from western countries about international trade in electricity, electric power contracts, and electricity pricing in market economies However, these countries are not interested in sharing power sector information with each other, in setting up a system of economic dispatch, or in conducting generation planning on a regional basis to identify least-cost solutions for the region as a whole These countries recognize the need to cooperate in the management of hydro resources, but they have not been able to work out their differences of opinion They also have not been able to work out a system of barter that enables all of the countries to settle their account payable within a few months None of them is experiencing an economic recovery

There is a Central Asia Energy Council with very high-level representation (including CEOs of power systems), but it is a political body that has not promoted regional cooperation at the technical level The council meets every quarter and the location and the chairmanship are rotated so that all countries are treated equally The council is roughly comparable to the Baltic Energy Council It has the authority to form a working group on electricity contracting and pricing

The United Dispatch Center in Tashkent is clearly interested in regional cooperation but it does not want to get into arguments with the member power systems, it would like to maintain good relations with all five countries, to protect the day-to-day operation of the grid Topics such as electricity price-setting and payment of debts are outside the Dispatch Center's authority It appears that there are no regular regional meetings at the United Dispatch Center

There was a meeting at the United Dispatch Center in May 1994 organized by EU TACIS in support of three regional projects in the electricity sector Oddly, there has been no follow-up To our knowledge a contractor has not been selected for any of the three projects and a regional working group has not been created According to an EU TACIS contractor in Kyrgyzstan, the "regional" programs may consist of training programs that are repeated in different countries, without an attempt to bring all the participants to the table to work out agreements

Obstacles to an electricity contracting and pricing project

Our assessment is that the political obstacles to an electricity contracting and pricing project are larger in Central Asia (in March 1996) than in the Baltic countries (in July 1992) For example, the regional dispatch center in Tashkent is a weaker organization and is perceived as pro-Uzbekistan and as a proponent of central planning and opponent of energy independence The Baltija Dispatch Center was the host and the coordinating organization in the Baltics, and the chief engineer of the Dispatch Center was designated by all three countries (through the Baltic Energy Council) as the chairman of the working group on contracting and pricing In Riga, most of the prepared speeches and presentations made by non-U S participants were made by Baltija Dispatch Center officials The Baltija Dispatch Center is located in a building owned by all three power systems and located very far from the Ministry of Economy (or the former Ministry of Industry and Energy) of Latvia We do not expect the same role to be played by the Unified Dispatch Center located in

Tashkent The Tashkent center is adjacent to the Ministry of Energy of Uzbekistan, in the same building complex, and looks as though it is part of the Ministry

Although all four countries we visited were interested in electricity contracts and other types of energy export contracts, they would prefer to discuss these topics with Americans (or other western experts) alone and not in the presence of their trading partners

When the Baltija Dispatch Center seminars are discussed, Central Asia counterparts appear to be very interested in the content of the contracts and the negotiation procedure, but they also express skepticism about the likelihood that the results of the seminars could be duplicated in Central Asia The Baltic countries are regarded as better prepared to make a transition to a market economy, and better prepared to establish trade on a businesslike, non-political basis There is a perception that electricity contracting must be easier to do in the Baltic region

Potential benefits of regional cooperation in the electric sector

Despite the strong nationalistic desire of Central Asian countries to reduce their energy imports, it appears that the potential benefits of regional cooperation in the electric sector of Central Asia are large Therefore it may be worthwhile for AID to support a project on regional electricity contracting and pricing even if the likelihood of seeing an improvement in the quality of signed contracts is much lower than in the Baltic countries If the potential benefits are large, it may be worth proceeding with a program in which the short-term indicators of achievement may be disappointing

Sustainable economic development of the five countries of Central Asia requires a reliable supply of electricity and a rational use of water for irrigation Regional cooperation in the operation of existing generation and transmission facilities will help these countries to (1) minimize the frequency and duration of power supply interruptions, and (2) minimize the true economic cost of electric generation and achieve an economically efficient use of resources

For Kyrgyzstan and Tajikistan, electricity generated from hydroelectric power represents a very large share of the value of exports These countries import natural gas, petroleum products, and coal, they have no oil refineries and they produce negligible quantities of fossil fuel, except for Kyrgyz coal production (which has been reduced due to the high cost of rail transportation from southern Kyrgyzstan through Uzbekistan and Kazakstan to Bishkek) A curtailment of electricity exports in Kyrgyzstan and Tajikistan could lead to shortages of all other energy supplies For the other three countries, electricity does not play such a key role in the balance of trade

If agricultural needs are taken into account, the operation of existing hydroelectric stations and the construction of future hydroelectric stations will promote agricultural development through rational and economically efficient use of water for irrigation Regional cooperation is needed because the Syr Darya and Amu Darya rivers cross international borders In the 5-country region hydropower represents 37 percent of installed capacity Although it represented only 27 percent of annual generation in 1985, we estimate that hydropower now represents about 35 percent of annual generation Hydroelectric generation is the primary source of electricity in Kyrgyzstan and Tajikistan If agricultural

requirements for water are ignored by power station operators, there will be inadequate summer flow due to the need to store water to meet electricity demand during the winter season

During the Soviet period agricultural lands in Central Asia were expanded into desert regions, using irrigation canals and electric pumping systems According to a Soviet publication on the Interconnected Power Grid (IPG), "Large-scale irrigation of lands, including pumping irrigation, appreciably influences the power requirements to be met by the IPG power plants and their operating conditions " In Uzbekistan, one-third of all electricity consumption in 1991 was in the agricultural sector, in Turkmenistan, more than one-fourth of electricity consumption in 1991 was in the agricultural sector Regional cooperation is needed to ensure a reliable supply of power to irrigated areas If the supply of electricity is curtailed in the agricultural sector, the cutback in irrigation will reduce the output of food and cotton Cotton exports from Turkmenistan and Uzbekistan play a key role in the national economy for these countries

The Kamburata project offers a technical solution to the problem of mixed use of water, but it may be difficult to finance In principle, Kyrgyzstan could build a new dam (Kamburata) above the existing Toktogul power station so that all of the winter season outflow from the Kamburata is captured by Toktogul and stored for the summer, when the water is released to provide irrrigation In the summer the electricity demand in the region is low and therefore the revenues from the sale of electricity may not be large enough to justify the $1 8 billion investment in Kamburata

Environmental protection of the Aral Sea region requires management of the flow of the Amu Darya and Syr Darya rivers The availability of water in the downstream portions of these rivers is strongly dependent on the amount of water released at hydroelectric power stations The Rogun and Totogul hydro stations have reservoirs large enough to manage year-to-year fluctuations in river flow The Nurek and Charvak hydro stations have reservoirs large enough to manage seasonal fluctuations in water flow Additional hydro stations with reservoirs large enough to manage seasonal flow have been proposed in Kyrgyzstan, Tajikistan, Uzbekistan, and Kazakhstan Regional cooperation in the planning and operation of hydro stations is an important factor in protecting the Aral Sea region

Environmental specialists may be able to determine whether water shortages associated with power failures and inadequate summer flow have implications for public health Drinking water shortages have occurred in the Ukraine and resulted in cholera If severe water shortages develop in the dryest parts of Central Asia there may be a cholera risk We assume that drinking water issues in Central Asia are addressed by AID's environmental program in the region

Other objectives Regional cooperation in the electric sector is likely to reduce the frequency and duration of power outages caused by generating unit failure and transmission system failure The effects of power outages are visible in other CIS countries, particularly Ukraine, Georgia, and Armenia, and in countries neighboring Central Asia, such as Aghanistan and Pakistan In a year with low precipitation, extended power outages will probably occur in parts of Central Asia as a result of the low level of hydro generation Power outages in the region will adversely affect AID programs supporting privatization and democratization

Privatization Extended outages will impede economic development and will reduce the productivity and profitability of enterprises that are candidates for privatization By reducing profitability, power failures will result in a lower level of foreign investment in economic sectors to be privatized

Democratization In Kazakhstan and Kyrgyzstan, popular support for a return to older methods of central planning could develop from the perception that the government has failed to provide essential services for the population such as electricity, drinking water, and (in Kazakhstan) district heat from power stations There are a few precedents for this pattern of political development, for example, the energy shortage in Lithuania in 1991-92 was a contributing factor toward the October 1992 election of former Communist leaders to run the government

Recommendations

A workshop program can be developed in three phases

Phase I Eight training seminars in which each country (Kazakhstan, Uzbekistan, Turkmenistan, Kyrgyzstan) has a customized program of two seminars based in its own capital city, without inviting neighboring countries The contractor would do four seminars in a two-week mission and four more in a follow-up mission

Phase II A seminar in Riga, Latvia at which all five Central Asian countries are invited This seminar would enable the Central Asian countries to meet on neutral territory and learn how the process of negotiation worked in the Baltics

Phase III Two seminars in Central Asia, with the participation of all five Central Asian republics The purpose of these seminars would be to try to identify issues in which agreements can be worked out and draft contracts can be discussed

The first phase can begin in August 1996, the second phase can begin in November or December 1996, and the third phase can begin in February 1997 The whole program should be completed in twelve months At the end of this period, AID could evaluate the cost-effectiveness of increasing the project budget and extending the time frame, so that there will be a greater likelihood that signed agreements will result from the project

Costs should be kept under control by scheduling seminars so that experts can be "borrowed" from other electric sector projects when these experts are conducting missions in the region One of the lawyers involved in drafting an electricity law, for example, could give a presentation on electricity contracts Transmission system experts from American Electric Power could provide sample contracts and could discuss NERC transmission reliability criteria Resident Hagler Bailly and Burns & Roe experts could also participate in workshops, if the topics match the areas of expertise of the resident experts

Attachment A Analysis of IEA Statistics on Energy Trade in Central Asia

IEA Statistics on Energy Use in Central Asia, 1991

	Kazakhstan	Kyrgyzstan	Uzbekistan	Turkmenistan	Tajikistan	5 country total	Russia	6 country total	Ukraine Georgia Armenia
Electricity, in GWh									
Electricity generated, GW	85,990	13,972	54,165	14,900	17 583	186,610	1,068,163		
Import	28,226	4,140	17,701	1,128	6,897	58,092	35,099		
Export	(12,735)	(8,432)	(18,085)	(6,303)	(5,396)	(50,951)	(47,160)		
Total energy supplied	101,495	9 688	53,789	9,723	19,085	193,779	1,056,295		
Losses	(8,129)	(1 058)	(5,071)	(1,396)	(2,896)	(18,550)	(237,485)		
Total final consumption	93,366	8 629	48,718	8,327	16,189	175,229	818,810		
Industry	60,313	3,908	25,865	#N/A	#N/A	#N/A	484,890		
Transport	6,315	140	1,593	#N/A	#N/A	#N/A	96,762		
Agriculture	14,130	3,128	15,573	#N/A	#N/A	#N/A	103,414		
Residential	0	965	4,175	#N/A	#N/A	#N/A	95,610		
Other	12,607	488	1,512	#N/A	#N/A	#N/A	38,135		
Net import	15,491	(4,291)	(384)	(5,175)	1,500	7,141	(12,060)		
Estimated imports from									
Kazakhstan	----------	337	9,397				**3,000**	12,735	
Kyrgyzstan	1,535	----------	**0**		*6,897*			8,432	
Uzbekistan	16,550	407	----------	*1,128*				18,085	
Turkmenistan			6,303	----------				6,303	
Tajikistan		3,396	**2,000**		----------			5,396	
Russia	10,141						----------	10,141	
Generation mix									
Coal	**62,000**	**1,050**	**4,000**	**0**	**0**	67,050	**140,000**		
Oil products	**7,550**	**764**	**4,820**	**0**	**0**	13,134	**124,056**		
Natural gas	**8,700**	**2,100**	**39,314**	**14,200**	**1,183**	65,497	**516,000**		
Total thermal	78,250	3,914	48,134	14,200	1,183	145,681	780,056		
Hydro	**7,200**	**10,058**	**6,031**	**700**	**16,400**	40,389	**168,123**		
Nuclear	**540**	**0**	**0**	**0**	**0**	540	**119,984**		

Generation mix in percent								
Coal	72 1%	7 5%	7 4%			35 9%	13 1%	
Oil products	8 8%	5 5%	8 9%			7 0%	11 6%	
Natural gas	10 1%	15 0%	72 6%	95 3%	6 7%	35 1%	48 3%	
Total thermal	91 0%	28 0%	88 9%	95 3%	6 7%	78 1%	73 0%	
Hydro	8 4%	72 0%	11 1%	4 7%	93 3%	21 6%	15 7%	
Nuclear	0 6%					0 3%	11 2%	
Share of regional total								
Electricity generated	46 1%	7 5%	29 0%	8 0%	9 4%	100 0%		
Total energy supplied	52 4%	5 0%	27 8%	5 0%	9 8%	100 0%		
Coal								
Production, 000 toe	**57,515**	**1,357**	**2,084**	**0**	**105**	61,061	**154,532**	
Import	**4,083**	**1,724**	**1,362**	**297**	**297**	7,763	**20,819**	
Export	**(23,061)**	**(772)**	**(235)**	**0**	**0**	(24,068)	**(16,695)**	
Total energy supplied	38,537	2,309	3,211	297	402	44,756	158,656	
Fuel used in power gen	**25,430**	**447**	**1,750**	**0**	**0**	27,627	**87,049**	
Estimated imports from								
Kazakhstan	---	1,724	1,362	297	62		19,616	23,061
Uzbekistan	**0**		---		235			235
Russia	4,083						---	4,083
Crude oil								
Production, 000 toe	**26,763**	**144**	**2,846**	**5,476**	**108**	35,337	**460,539**	
Import	**12,663**	**0**	**5,645**	**1,691**	**0**	19,999	**12,563**	
Export	**(20,949)**	**(144)**			**(108)**	(21,201)	**(175,272)**	
Net addition to stocks			**(552)**					
Total energy supplied	18,477	0	7,939	7,167	0	33,583	297,830	
Estimated imports from								
Kazakhstan	---		5,393	1,691			13,865	
Kyrgyzstan		---	144	**0**				
Turkmenistan			0	---				
Tajikistan			108	**0**	---			
Russia	12 663		**0**	**0**			---	

Oil products										
Refinery production 000 t	**17,906**	**0**	**7,479**	**6,775**	**0**	32,160	**270,443**			
Import	**8,145**	**2,388**	**3,560**	**1,005**	**1,971**	17,069	**5,760**			
Export	**(3,258)**	**0**	**(725)**	**(4,423)**	**0**	(8 406)	**(53,700)**			
Total product supplied	22,793	2,388	10,314	3,357	1,971	40,823	222,503			
Fuel used in power gen	**2,880**	**310**	**2,208**	**0**	**0**	5,398	**61,468**			
Estimated imports from										
Kazakhstan	----------	2,388	870					3,258		
Uzbekistan			----------		725			725		
Turkmenistan				----------	1,246		3,177	4,423		
Russia	8 145			1,005			----------	9,150		
Natural gas										
Production, 000 toe	**6,612**	**46**	**33,887**	**68,179**	**81**	108,805	**458,368**			
Import	**10,733**	**1,696**	**0**	**0**	**1,307**	13,736	**15,632**			
Export	**(3,529)**	**0**	**(2,368)**	**(57,163)**	**0**	(63,060)	**(139,516)**			
Total energy supplied	13,816	1,742	31,519	11,016	1,388	59,481	334,484			
Fuel used in power gen	**3,773**	**867**	**11,923**	**3,838**	**653**	21,054	**148,046**			
Estimated imports from										
Kazakhstan	----------	635	0				2,894	3,529		
Uzbekistan		1,061	----------		1,307			2,368		
Turkmenistan		**0**		----------				0	57,163	
Russia	10,733	**0**		0			----------	10,733		
Hydroelectric energy										
Production, 000 toe	**619**	**865**	**519**	**60**	**1,410**	3,473	**14,481**			
Nuclear energy										
Production 000 toe	**141**	**0**	**0**	**0**	**0**	141	**31,269**			

Electricity, in 000 toe							
Production 000 toe	**7,395**	**1,202**	**4,658**	**1,281**	**1,512**	16,048	**91,862**
Import	**2,427**	**356**	**1,522**	**97**	**593**	4,995	**3,018**
Export	**(1,095)**	**(725)**	**(1,555)**	**(542)**	**(464)**	(4,381)	**(4,055)**
Total energy supplied	8,727	833	4,625	836	1,641	16 662	90,825
Losses	**(699)**	**(91)**	**(436)**	**(120)**	**(249)**	(1,595)	**(20,420)**
Total final consumption	8,028	742	4,189	716	1,392	15,067	70,405
Industry	**5,186**	**336**	**2,224**	**#N/A**	**#N/A**	#N/A	**41,693**
Transport	**543**	**12**	**137**	**#N/A**	**#N/A**	#N/A	**8,320**
Agriculture	**1,215**	**269**	**1,339**	**#N/A**	**#N/A**	#N/A	**8,892**
Residential	**0**	**83**	**359**	**#N/A**	**#N/A**	#N/A	**8,221**
Other	1,084	42	130	#N/A	#N/A	#N/A	3,279
District heat, in 000 toe							
Production, 000 toe	**#N/A**	**578**	**2,866**	**#N/A**	**#N/A**	#N/A	**92,745**