

RRP:KGZ 29024

ASIAN DEVELOPMENT BANK

**REPORT AND RECOMMENDATION
OF THE
PRESIDENT
TO THE
BOARD OF DIRECTORS
ON A
PROPOSED LOAN
TO THE
KYRGYZ REPUBLIC
FOR THE
POWER AND DISTRICT HEATING REHABILITATION PROJECT**

May 1996

CURRENCY EQUIVALENTS

(as of 30 April 1996)

Currency Unit	-	Som
\$1.00	=	Som11.60
Som1.00	=	\$0.0862

The exchange rate of the som is determined on a managed float basis through periodic foreign exchange auctions. The calculations in this Report are based on an exchange rate of Som11.00 to \$1.00.

ABBREVIATIONS

DANIDA	-	Danish International Development Agency
EBRD	-	European Bank for Reconstruction and Development
IDA	-	International Development Association
KNEHC	-	Kyrgyz National Energy Holding Company
NDF	-	Nordic Development Fund
PCB	-	Polychlorinated biphenyl (an industrial chemical)
PIU	-	Project Implementation Unit
PRC	-	People's Republic of China
TES1	-	Bishkek Thermal Energy Station No. 1
USAID	-	United States Agency for International Development

WEIGHTS AND MEASURES

Gcal	(gigacalorie)	-	1 million calories
GWh	(gigawatt-hour)	-	1 million kWh
kV	(kilovolt)	-	1,000 volts
kWh	(kilowatt-hour)	-	1,000 watt-hours
MW	(megawatt)	-	1,000 kilowatts
t	(metric ton)	-	1,000 kilograms
Tcal	(teracalorie)	-	1 trillion calories
toe	(ton of oil equivalent)	-	common energy unit

NOTES

- (i) The fiscal year of the Government ends on 31 December.
- (ii) In this Report, "\$" refers to US dollars.

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**KYRGYZ REPUBLIC
POWER AND DISTRICT HEATING REHABILITATION PROJECT
LOAN AND PROJECT SUMMARY**

Borrower	:	Kyrgyz Republic
Project Description	:	The Project will involve rehabilitation of the thermal cogeneration plant in Bishkek, rehabilitation of the district heating facilities in Bishkek, reinforcement and rehabilitation of power transmission and distribution facilities in selected substations throughout the country, and strengthening of operational and management capabilities of the national power utility.
Classification	:	Primary — Economic Growth
Environmental Assessment	:	Category B An initial environmental examination was undertaken, and the summary is presented as a core appendix.
Rationale	:	Given the urgent need to overcome power and heat supply constraints and to increase the efficiency of supplying and utilizing energy, priority will be given in the short term to (i) retrofitting of the cogeneration plant in Bishkek; (ii) rehabilitation of the district heating systems in Bishkek; and (iii) rehabilitation and extension of the power transmission and distribution facilities in the country. Concurrent attention will be given to gradually correcting the pricing for electricity and heat with careful attention to providing a social safety net for vulnerable groups. The proposed Project will result in reduced power, water, and heat losses and consequent environmental improvement; increased effective capacity to supply and deliver power and heat; reduced power outages and improved voltage stability; improved dispatching of heat to consumers; reduced operation and maintenance costs; extended life of the rehabilitated assets; and enhanced project management capabilities of the Kyrgyz National Energy Holding Company (KNEHC), the executing agency.
Objectives and Scope	:	<p>The Project will support economic growth of the country through rehabilitation and upgrading of the electricity and heat supply infrastructure. The Project scope comprises:</p> <p>Part A: Bishkek Thermal Energy Station Rehabilitation. Retrofitting of boilers, installation of a 90-MW turbogenerator, and upgrading of plant instrumentation.</p> <p>Part B: District Heating Rehabilitation. Replacement of dilapidated pipes (20 km), installation of variable speed pumps, and provision of meters and control equipment.</p>

Part C: Power Transmission and Distribution Reinforcement. Reinforcement and rehabilitation of substations and distribution facilities and control equipment.

Part D: Technical Support and Training. Provision of assistance in implementation of the Project, and strengthening of general and financial management of KNEHC.

Cost Estimates

(in \$ million equivalent)

Component	Foreign Exchange	Local Currency	Total Cost
Base Cost	61.2	12.0	73.2
Contingencies	9.9	4.3	14.2
IDC	1.3	9.7	11.0
Total	72.4	26.0	98.4

Financing Plan

(in \$ million equivalent)

Source	Foreign Exchange	Local Currency	Total Cost	Percent
Bank	30.0	-	30.0	30
World Bank	18.9	1.1	20.0	20
DANIDA ^a	8.6	-	8.6	9
NDF ^b	6.8	-	6.8	7
Switzerland	4.5	-	4.5	5
KNEHC	-	15.2	15.2	15
Government	3.6	9.7	13.3	14
Total	72.4	26.0	98.4	100

^a Danish International Development Agency

^b Nordic Development Fund

Loan Amount and Terms

A loan of in various currencies of Special Drawing Rights 20,483,000 (\$30.0 million equivalent) from the Bank's Special Funds resources with a repayment period of 40 years including a grace period of 10 years, carrying a service charge of 1.0 percent per annum.

Cofinancing

The Government has also requested loans from the International Development Association (IDA), the Danish International Development Agency (DANIDA), the Nordic Development Fund (NDF), and the Swiss Government to help finance the Project on a parallel cofinancing basis. IDA would provide \$20 million equivalent, with a service charge of 0.75 percent and 35 years maturity including a 10-year grace period. DANIDA would provide

\$8.6 million equivalent at no interest with a repayment period of 10 years after loan drawdown including a 1-year grace period. NDF would provide \$6.8 million equivalent on terms similar to those of IDA. The Swiss Government would provide a grant of \$4.5 million.

Allocation and Relending Terms	:	The Borrower will relend the proceeds of the loan from the Bank to KNEHC under a subsidiary loan agreement. The relending interest rate will be equivalent to the Bank's variable lending rate for multicurrency loans from its ordinary capital resources, with the foreign exchange risk to be borne by the Government, and a repayment period of 15 years including a 4-year grace period.
Period of Utilization	:	Until 30 June 2000
Executing Agency	:	KNEHC
Implementation Arrangements	:	KNEHC will be responsible for the supervision and implementation of the Project through a Project Implementation Unit (PIU) established for the Project. The PIU will be supported by implementation consultants financed under the Project.
Procurement	:	Procurement of all goods, materials, and equipment to be financed by the Bank will be carried out in accordance with the Bank's <i>Guidelines for Procurement</i> on an international and local competitive bidding procedures. Procurement of cofinanced components of the Project will be undertaken using the guidelines of the cofinancier concerned.
Consulting Services	:	International consultants will be required to provide project management assistance in such matters as engineering design, tendering, supervision of installation, testing and commissioning, and training. Total consulting services requirements, in five packages (excluding studies under Part D), are estimated at about 118 person-months of international consultant input and 60 person-months of domestic consultant input. Two of the consulting services packages, those for Parts B and C, will be financed under the Bank loan. For these, about 50 person-months of international consultant input will be required; consultants will be engaged in accordance with the Bank's <i>Guidelines on the Use of Consultants</i> . The consultant input requirements for the studies under Part D will be determined later during the course of Project implementation.
Estimated Project Completion Date	:	31 December 1999

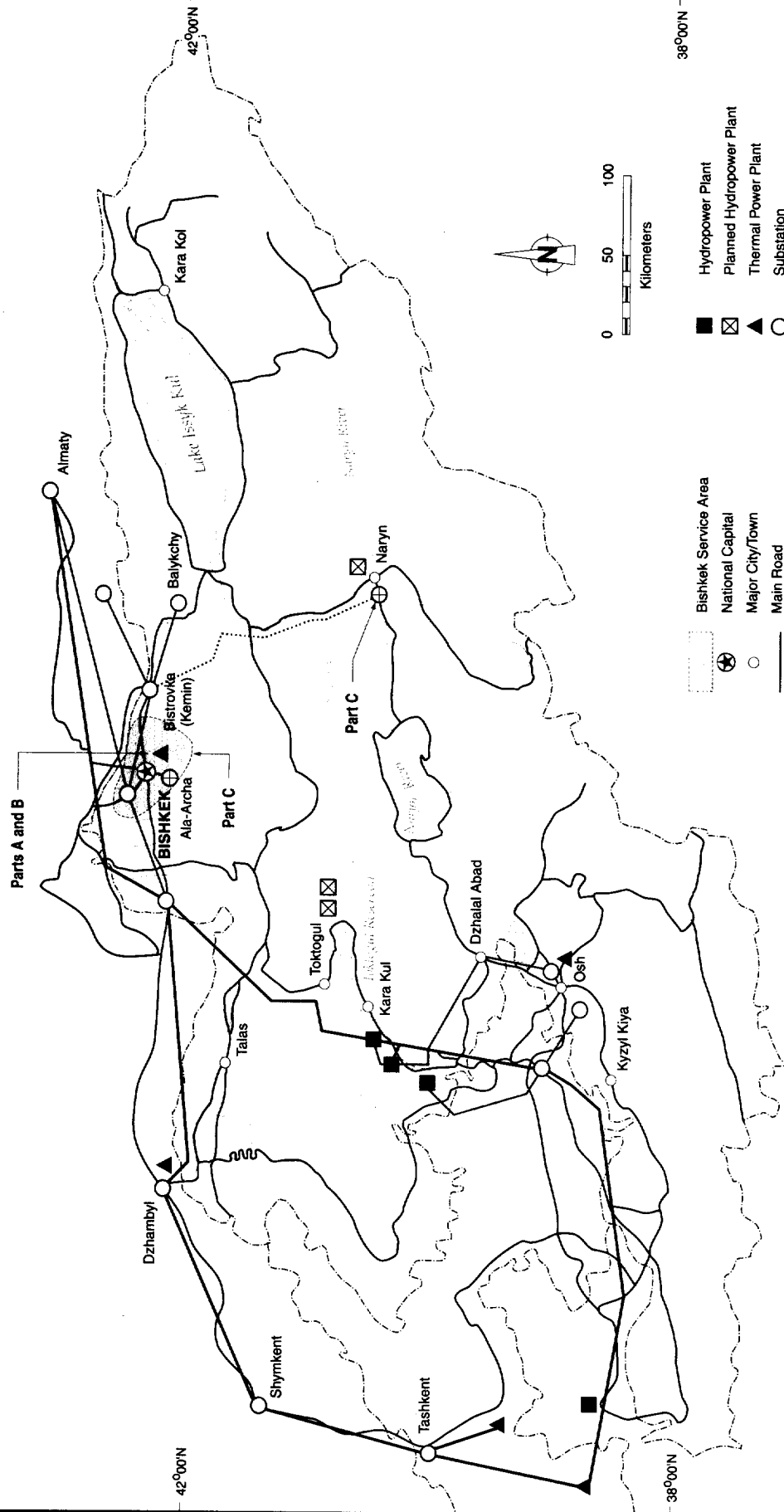
**Project Benefits
and Beneficiaries** :

The Project will support economic development and provide the following direct benefits: (i) reduced power, water, and heat losses (with savings of about \$9.0 million in imported fuel per year); (ii) increased effective capacity to supply and deliver power and heat; (iii) reduced power outages (with estimated economic cost savings of about \$6.8 million per year) and improved voltage stability; (iv) improved dispatching of heat to consumers (estimated reduction of consumer demand by 5 percent); (v) reduced operation and maintenance costs (estimated at \$2.3 million per year); and (vi) extended life of the rehabilitated assets. The technical support and training component will enhance project management capabilities within KNEHC.

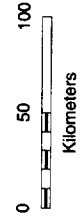
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KYRGYZ REPUBLIC POWER AND DISTRICT HEATING REHABILITATION PROJECT



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|---|---|
| <p>■ Bishkek Service Area</p> <p>● National Capital</p> <p>○ Major City/Town</p> <p>— Main Road</p> <p>— Main River</p> <p>--- International Boundary</p> <p>(Boundaries not necessarily authoritative)</p> | <p>■ Hydropower Plant</p> <p>▣ Planned Hydropower Plant</p> <p>▲ Thermal Power Plant</p> <p>○ Substation</p> <p>⊕ Planned Substation</p> <p>— 500-kV Line</p> <p>— 220-kV Line</p> <p>..... Planned 220-kV Line</p> |
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I. THE PROPOSAL

1. I submit for your approval the following Report and Recommendation on a proposed loan to the Kyrgyz Republic for the Power and District Heating Rehabilitation Project.

II. INTRODUCTION

2. The Kyrgyz economy is in transition from a command to a market system, and the consumption of electricity and heat in the production sectors has dropped sharply since 1991. In contrast, electricity consumption by the residential sector, practically 100 percent of which has access to electricity, has more than doubled over the same period, leading to overloaded power transmission and distribution facilities. This increased electricity consumption is due mainly to the residential consumers switching over to indigenously produced electricity for heating and cooking purposes and moving away from imported forms of commercial energy, which have rapidly increased in price. The poor condition of district heating systems in the major urban areas has also been a significant contributing factor to this increased electricity consumption. The Government recognizes the need to overcome capacity constraints associated with electricity and heat supply, and the importance of increasing the efficiency of supplying and utilizing energy. Towards this end, priority is being given in the short-term to (i) rehabilitation of the combined heat and power plant in Bishkek, (ii) rehabilitation and extension of the power transmission and distribution system, and (iii) rehabilitation of the district heating systems in Bishkek and Osh. Concurrent consideration is also being given to gradually correcting the pricing structure for electricity and heating energy, with careful attention to providing a social safety net for vulnerable groups.

3. It was agreed with the Government that a power and district heating rehabilitation project could be jointly prepared by the Bank and the International Development Association (IDA) of the World Bank. The proposed Project will result in reduced power, water, and heat losses and consequent environmental improvement; increased effective capacity to supply power and heat, and improved dispatching of heat to consumers; reduced power outages, and improved voltage stability; reduced operation and maintenance costs; extended life of the rehabilitated assets; and enhanced project management capabilities of the Kyrgyz National Energy Holding Company (KNEHC), the Executing Agency. It is based on a project preparatory study financed by the United States Agency for International Development (USAID). A midterm report for the study¹ was prepared in March 1995 and was reviewed jointly in April 1995 by a Bank Fact-finding Mission and an IDA Preappraisal Mission. A September 1995 Bank Appraisal Mission,² undertaken jointly with an IDA Appraisal Mission,³ confirmed that the Project was economically and financially viable and was suitable for Bank financing. A mission from the Danish International Development Agency (DANIDA),⁴ which also represented the interests of the Nordic Development Fund (NDF), participated in the joint appraisal activities. This Report

¹ Including inputs from findings of the Energy Advisory Group for the Kyrgyz Republic, financed under the European Union's Technical Assistance for the Commonwealth of Independent States.

² The Bank Appraisal Mission comprised J. Ordoña (Senior Financial Analyst/Mission Leader); S. O'Sullivan (Senior Project Economist); C.N. Chong (Project Engineer); G. Atay (Counsel); and G. Grøn (District Heating Expert/Consultant).

³ The IDA Appraisal Mission comprised S. Ouahes (Senior Power Engineer/Mission Leader); J. Koch (Senior Power Economist); M. Heitner (Senior Financial Analyst); E. Finkel (Social Scientist/Consultant); and V. Sirohi (Environmental Specialist).

⁴ The DANIDA Mission comprised B.G. Andersen.

is based on the findings of the project preparatory study, those of the Bank-IDA joint missions, discussions with officials of the Government and KNEHC, and agreements reached during loan negotiations in Manila between 27 and 28 March 1996.

III. BACKGROUND

A. Sector Description

1. The Energy Sector

a. Sector Overview

4. The energy sector in the Kyrgyz Republic is relatively large and plays an important role in the economy. The country has abundant hydropower resources and an unexplored potential in oil, gas, and coal. Under the former Soviet Union, the country's economy evolved from one based largely on agriculture to one with a significant industrial base. In 1990, just prior to independence, industrial activities accounted for about 40 percent of the gross domestic product. While the country is a net importer of oil, gas, and coal, it exports hydroelectric power, generated mainly along the Naryn River, to its neighbors.

5. Trade in energy has a significant negative impact on the balance of payments, as imports heavily outweigh exports. In 1993, energy imports were \$171 million or about 35 percent of total imports, while exports (essentially electricity) amounted to only \$31 million, about 10 percent of total exports. The energy trade balance improved somewhat in 1994, with exports of about \$73 million compared with imports of about \$160 million, as a result of increased electricity exports and reduced energy imports caused by the continued decline in economic activity. Net energy imports, however, are expected to increase, as the consumption of imported energy is likely to rise with the resumption of economic growth. Prospects for increasing electricity exports in terms of both volume and value are limited in the short to medium term because of the restricted electricity demand in the neighboring countries and the low level of prices. Measures to promote the efficient use of energy and to increase domestic oil and gas production are vital to reducing the negative impact of energy imports on the country's overall balance of payments.

6. The country's future energy production and trade will depend on a number of key factors including (i) the rate of economic recovery in the Kyrgyz Republic and the neighboring countries; (ii) the trading arrangements negotiated with the neighboring countries; and (iii) the country's ability to attract private sector participation and financing to further develop the production of domestic coal, oil, natural gas, and hydroelectric energy. It is expected that the agriculture and services sectors will lead the pace of recovery in the country, followed by the industry sector. Regional energy trade will continue to be critically important for the country, and negotiating long-term contracts for power exports with equitable terms is a high priority for the Government.

7. The Government recognizes the important role of the energy sector in the economic recovery and growth of the country but expects the sector to become increasingly self-financing and to reduce its demands on the national budget. The Government is now in the process of establishing policies that call for increased efficiency in energy production and use, reduced Government involvement in the sector, and efforts to attract private sector involvement

in developing domestic resources. The reduced pressure at present on the supply capacity of the energy sector provides an important opportunity for rehabilitation of the sector in preference to adding new capacity.

b. Primary Energy Sources

8. The country possesses abundant hydropower resources, which have been well investigated and partially developed. Only about 10 percent of its hydropower potential of 26,000 megawatts (MW) has been developed (present hydropower generation capacity totals 2,740 MW). The Naryn River, which today provides the bulk of the country's electricity generating capacity, offers the prospect of an additional 2,200 MW of hydropower capacity at relatively low unit cost, but requiring a sizeable capital outlay. Numerous other hydropower generation sites also exist, including some suitable for small-scale hydropower projects. The annual electricity generation potential of small-scale hydropower plants is estimated at 7 billion kilowatt-hours (kWh), of which only 3 percent has been exploited. As to renewable energy, it is noteworthy that the wind speed on many valleys is 4-5 meters per second and offers substantial energy generation potential.

9. Known petroleum resources are modest, but there are about 12 million metric tons (t) of oil and 6.5 billion cubic meters (m³) of gas in the Fergana basin. Other potentially promising oil-bearing areas, such as the Chui valley south of Bishkek and the Aksai valley south of Issyk Kul Lake, remain to be explored. There are large coal deposits totalling about 2 billion t in four basins. Proven coal reserves are about 1.2 billion t, and about 650 million t are ready for mining. In terms of nontraditional sources of energy, it is estimated that about 15 percent of the approximately 100,000 t of dung produced could be processed in biogas plants to produce about 1.0 million gigacalories (Gcal) of heat. The forests have wood resources estimated at 23 million m³; this, however, is being threatened by illegal cutting for fuel.

c. Energy Supply and Demand

10. Considering the recent decline in the demand for energy in the Kyrgyz Republic, the energy balance for 1991 would be more indicative of energy sector development than the energy balance for 1994 (see Appendix 1). About 51 percent of the country's primary energy sources in 1994 were imported as compared with 61 percent in 1991. Most petroleum product imports come from Kazakhstan and Russia. Natural gas comes from Turkmenistan via Uzbekistan. In 1994, the Kyrgyz Republic had net imports of about 1.2 million t of coal, 0.7 million t of petroleum products, and 1.0 billion m³ of natural gas, compared with net imports of about 0.9 million t of coal, 2.6 million t of petroleum products, and 2.1 billion m³ of natural gas in 1991. Imports of primary energy, especially in the form of petroleum products and natural gas, have fallen sharply since 1991 because of local price increases to international levels.

11. Between 1991 and 1994, final domestic energy consumption fell from about 5.4 million tons of oil equivalent (toe) to about 2.3 million toe. The economic slowdown also caused a change in the sectoral consumption pattern. Residential consumers accounted for 45 percent of energy use in 1994, while industrial users accounted for 28 percent; in 1991, 29 percent was used by residential consumers and 40 percent by industrial users. In 1994, total commercial primary energy consumption (including conversion and transmission losses) in the country was about 3.0 million toe, or a per capita consumption of about 0.7 toe. This was about 30 percent higher than the average for the Bank's developing member countries, mainly because

of the relatively low end-use efficiency and electricity tariffs in Kyrgyz Republic. With the rise in the prices of imported fuels towards international levels during the past few years, the Government has encouraged greater use of electricity (generated mainly by hydroelectric plants) to displace imported fuels used for heating. The near total electrification of the country has enabled the residential sector to switch rapidly to electricity for heating and cooking (through replacement of boilers using coal, fuel oil, and natural gas by electrical boilers) in response to continued real increases in the prices of alternative energy sources. Consequently, the consumption of coal decreased from 4.4 million t in 1991 to 1.9 million t in 1994; petroleum products decreased from 2.59 million toe to 0.70 million toe; and electricity as a primary energy source increased from 5,766 gigawatt-hours (GWh) to 8,205 GWh.

d. Energy Pricing

12. The current energy prices in the Kyrgyz Republic are compared in Table 1 with average market prices levied by commercially oriented energy utilities in the Asian region. Prices of coal, petroleum products, and natural gas for industry are now largely at international market levels, with import prices being passed on to consumers. This price liberalization is in line with the Government's general policy of eliminating distortions caused by the former command economy and reducing the State's role. However, electricity, district heating, and residential natural gas prices remain under Government control and have been kept artificially low and structured in favor of residential consumers because of the Government's sensitiveness about inflation and the consumers' ability to pay. This has led to distorted energy consumption patterns, inequitable pricing among some consumer categories, and deteriorating financial condition of the energy supply utilities. The Government has agreed with the International Monetary Fund, as part of its 1994-1997 stabilization program, to raise energy tariffs to achieve cost recovery in the first instance. Further increases will be necessary to ensure the ability of the energy supply utilities to make necessary investments to rehabilitate and expand their

Table 1: Energy Prices in the Kyrgyz Republic

Fuel	August 1993		September 1994		September 1995	Average Market ^a 1995	Kyrgyz to Average Market
	(Som)	(\$)	(Som)	(\$)	(\$)	(\$)	(%)
Petroleum Products (per t)							
Gasoline	863	144	3990	376	264	157	168
Diesel	688	115	3200	302	213	150	142
Fuel Oil	337	56	840	79	108	99	109
Natural Gas (per t)							
Industry	255	42	992	94	94	100	94
Residential	128	21	953	90	94	180	52
Coal (per t)	73	12	340	32	32	30-40	80-107
Electricity (per kWh)							
Industry	0.055	0.009	0.110	.010	0.010	0.045-0.075	14-23
Residential	0.030	0.005	0.060	.006	0.006	0.075-0.125	5-8
District Heating (per Gcal)							
Industry	48	8	124	11.70	11.20	25-45	25-45
Residential	5	0.8	15	1.42	1.36	25-45	3-5

^a Commodity prices in the international market and utility prices in Bank's Asian DMCs.

facilities as well as to maintain healthy financial conditions. However, the Government recognizes the concurrent need to protect vulnerable groups from adverse life quality-threatening impacts that could arise from the increasing energy prices.

e. Energy and Environment

13. A national environmental action plan for the Kyrgyz Republic has been prepared with the assistance of the World Bank. The priority areas for the energy sector include watershed management (affecting hydropower resources) and dam safety; emissions from coal-fired thermal plants and boilers; and coal mining operations (including pending closures of uneconomic mines). Attention is being given under the action plan to reviewing and developing environmental standards and regulations, strengthening of monitoring and enforcement capabilities, and developing the capacity to carry out environmental impact assessments and efficiency and environmental audits. The proposed Project will improve efficiency in the production and use of electricity and heat (including reduction in water usage), and will upgrade instrumentation, control, and monitoring devices at the Bishkek thermal plant.

f. Energy Sector Institutions

14. The energy sector in the Kyrgyz Republic comprises six State-owned enterprises responsible for electricity and district heating (KNEHC); coal mining (Kyrgyzkumyr); coal distribution (Kyrgyztopsna); petroleum exploration and production (Kyrgyzneft); petroleum products distribution (Kyrgyzmunaizat); natural gas distribution (Kyrgyzgas); and one State committee (Goskomgeologia) responsible for mineral resources (including petroleum) exploration on a national level. The Deputy Prime Minister directly oversees electricity and district heating activities and minerals and petroleum exploration. One Deputy Minister of Trade and Industry is entrusted with supervising domestic production of coal, natural gas, and oil. A second Deputy Minister supervises the import of natural gas and the operations of the natural gas utility, and exercises functions related to the supervision and control of trade with Turkmenistan and Uzbekistan. A third Deputy Minister deals with trade with Russia and has oversight over the imports of petroleum products and their distribution.

15. Other State organizations involved in the energy sector are the Ministry of Economy and the State Property Fund. The Ministry of Economy, through its Price Commission, controls the prices of certain commodities including electricity, gas, and heat; and, through its Anti-Monopoly Commission, controls the prices of petroleum products. The State Property Fund manages the Government's holdings in State enterprises and as such has been particularly concerned with the formulation of privatization plans. The domestic private sector has ventured into trading and distributing petroleum products, liquid petroleum gas, and coal, and coal mining.

16. At present these public sector enterprises remain responsible for most of the activities in the energy sector. Except for Kyrgyzneft, these enterprises have been cut off from the national budget, and are responsible for their own management. Their financial management in particular is weak, and lacks commercial orientation. Since most decisions taken prior to the country's independence were made by the central authorities of the former Soviet Union, local expertise in policy and planning matters is limited. Under the proposed Project, assistance will be provided for developing an overall strategy for restructuring the power and heat sector and for the commercialization of KNEHC (see para. 53); this will build on previous institution-building

assistance provided by the European Union and the European Bank for Reconstruction and Development (EBRD).

17. The Government has been making efforts in the past three years to reorganize the power and heat sector and to privatize certain activities. However, the lack of a legal and regulatory framework, and weaknesses in the overall organization have prevented significant progress. Since 1994, the European Union and USAID have been providing assistance in drafting a framework energy law and an electricity law. These draft laws were submitted to Parliament for enactment in early 1996. A State Energy Agency was also established to take over sectoral regulatory functions upon the enactment of these laws. Such enactment is a condition of effectiveness of the proposed loan. Draft laws are also being prepared to cover the petroleum subsector and regulations on subsurface resources. The Government is currently reviewing the status of the public energy enterprises with the aim of restructuring, commercializing, and ultimately privatizing those that are viable, and closing those that are not.

2. Electricity

18. The Kyrgyz Republic is practically fully electrified, with all urban households and 99 percent of rural households having electricity service connections. KNEHC is the national utility responsible for the service functions of the power and heat subsectors. It operates ten major power plants with a total installed capacity of about 3,400 MW, including eight hydropower plants (2,740 MW) and two thermal cogeneration plants: one in Bishkek (609 MW) and another in Osh (50 MW). In 1994, KNEHC generated 12,700 GWh (1,100 GWh from thermal plants and 11,600 GWh from hydroelectric plants) and exported a net of 2,500 GWh to Kazakhstan and Uzbekistan. The peak load in 1994 was 2,170 MW. The system is currently not constrained by generating capacity but is limited by the transmission and distribution network capacity. Over the past four years, the share of residential power consumption increased from 15 to 40 percent, while that of industrial consumption declined from 45 to 26 percent. The tripling of residential power consumption from 1,111 GWh in 1990 to 3,159 GWh in 1994 is due mainly to the artificially low price set for electricity, particularly relative to alternative heating and cooking fuels.

19. The power system serving the Kyrgyz Republic is connected to the Central Asian 500-kilovolt (kV) grid serving Uzbekistan, Turkmenistan, and Kazakhstan also. The operations of this grid are controlled at Tashkent. A salient operational feature is the reliance that Uzbekistan and Kazakhstan place on irrigation water from the Naryn River, regulated upstream by Kyrgyz hydropower dams. Hydroelectric power development along the Naryn River began in the 1960s with the construction of the Toktogul reservoir (16 billion m³) and four downstream projects in the Lower Naryn River (see Map on page (vi)). These projects now generate an average of 10,000 GWh annually. Since water releases are highest in summer because of peak irrigation requirements in downstream countries, electricity production by the Kyrgyz Republic in the summer exceeds its internal demand. Conversely, electricity generation is restricted in winter, when local electricity demand is at its highest, because of the requirement to store water for summer irrigation. This seasonal imbalance enables the country to export electrical energy in the summer, but the energy imports required in winter outweigh these energy exports.

20. A second phase in hydroelectric power development, planned before the breakup of the former Soviet Union, was to develop sites upstream of the Toktogul reservoir that could be operated without the irrigation constraints in winter. These include Kambarata 1 (1,900 MW) and Kambarata 2 (250 MW), which are estimated to have relatively low unit costs in the order

of \$900 per kilowatt (kW). However, the total investment requirement of about \$2 billion is out of proportion with the size of the country's present economy. The Kambarata 2 Project was started in 1989, but construction work has stopped because of lack of funds; about \$250 million is required to complete it. Further development of these hydropower projects would have to be preceded by satisfactory long-term power export agreements to ensure their viability.

21. There are thermal cogeneration plants in the cities of Bishkek and Osh. The Bishkek Thermal Energy Station No. 1 (TES1), with a rated capacity of 609 MW, consists of 10 steam turbine generators and 24 boilers with the capability of burning either coal, fuel oil, or natural gas. When operating in a cogeneration mode, TES1 has a nominal capacity of 558 MW of electricity and 1,290 MW (1,157 Gcal/hour) of heat output. At present, TES1 burns mainly Kazakh coal procured under barter arrangement. The Osh thermal plant, with a rated capacity of 50 MW, consists of two steam turbines and three boilers, which are designed to burn fuel oil and natural gas.

22. TES1 plays a key role in the power supply of the country's northern region and in the supply of heat for Bishkek. However, 13 of its 24 boilers have accumulated over 100,000 hours of operation, and the other 11 relatively newer boilers are also due for refurbishment and life extension work. Also, four of the ten turbines have accumulated over 200,000 hours of operation each and need to be monitored regularly with nondestructive metallurgical tests. A new 90 MW turbine is awaiting installation at TES1. Other problems of TES1 include obsolescence and wear of plant auxiliary systems for coal handling, compressed air, make up water, air pollution control, ash storage, and instrumentation and control. These problems negatively affect plant availability and efficiency, and increase environmental pollution. The plant used to undergo major repair work annually, but because of financial constraints, the maintenance programs have been drastically reduced. Furthermore, plant maintenance problems are becoming critical as more and more low-grade, high-ash coal, procured through barter deals, is being used. Refurbishment of TES1 is the least-cost alternative to maintain the supply of power and heat to the city of Bishkek in the medium term.

23. The country's transmission system consists of 500-kV (540 km), 220-kV (1,010 km), and 110-kV (4,300 km) lines. There are 481 step-down transformer substations with a total capacity of 7,790 megavoltamperes (MVA). The transmission system is part of the Central Asian Integrated System integrated at 500-kV and 220-kV. Power distribution is carried out at 10-kV, 6-kV, and 0.4-kV. The recent rapid increase of electricity use by households in particular is subjecting the power distribution system to overloads that shorten the lifespan of power system equipment. For example, in the winter of 1993/94, about 2,200 of KNEHC's 17,000 transformers were overloaded. KNEHC's system losses were 17 percent of net generation in 1994 and are estimated at 20 percent for 1995.¹ There is also an urgent need to rehabilitate and reinforce about 25 percent of the 10-kV and 40 percent of the 0.4-kV distribution lines. Given the increased level of electricity distribution, large-scale distribution expansion at 10-kV and 6-kV is, however, not feasible because of capacity and loss limitations, and such expansion in the longer term will have to be provided at voltages of the order of 20 to 35-kV.

¹ A well-designed power system with the generation and load structure of KNEHC should have net system losses of about 12 percent.

3. District Heating

24. The two major thermal cogeneration plants in Bishkek and Osh, which have steam generating capacities of 4,250 t per hour and 375 t per hour, respectively, are designed to supply heat to the district heating network. There are two small (less than 10 MW) cogeneration plants in Kyzyl Kia and Kara Kul. In addition, heat is supplied from heat-only boilers for heat requirements in the towns of Kara Kol, Kara Kul, and Kyzyl Kiya, and to meet the peak heat load requirements in Bishkek and Osh. The Bishkek district heating system accounts for about 80 percent of the centralized heat supplied throughout the country. Over 400,000 people in Bishkek are provided with heat and hot water from this system; also, a number of industrial consumers use its process steam and hot water.

25. The district heating network in Bishkek consists of about 400 km of hot water pipelines and 33 km of steam lines. The district heating system is designed with control of temperature at the heat source (cogeneration or heat-only boilers). Because of insufficient drainage around underground pipes located in wet soil, as well as missing weather shields, insulation has deteriorated and corrosion has accelerated. This has substantially reduced the economic life of the network and caused large water and heat losses. Currently, system losses in the district heating system in Bishkek are in the order of 25 percent of heat generated¹ and result in large economic costs. Annual major repairs and pipe replacement activities have decreased significantly since 1991 mainly because of lack of funding, further exacerbating the deterioration rate of the system operating efficiency. There are no meters for residential consumers, and only about 10 percent of industrial users have meters in working condition. Much of the billing is done based on floor area estimates, and overall losses, both technical and nontechnical, are high. Investment in the rehabilitation of the Bishkek district heating network is given high priority by KNEHC and the Government.

4. Projected Demand for Electricity and District Heating

26. The demands on KNEHC for electricity and heat consumption are conservatively projected to grow at about 2.9 percent a year and 3.5 percent a year, respectively, over the next five years, as shown in Table 2.

B. Government Policies and Strategies

27. The Government of the Kyrgyz Republic is fully committed to policy reforms to guide the country's transition to a market-oriented economy. The key medium-term goals that have been cited by the Government in the reform process include (i) consolidation and intensification of the stabilization and structural reform measures taken; (ii) establishment of the legal, institutional, and regulatory framework for renewed growth; and (iii) maintenance of an adequate social safety net program and reduction of rural poverty. Within this broad reform program, improvement of energy sector performance is an important element, and actions required for this sector's improvement parallel those required for the overall economy.

¹ Normal losses in similar district heating systems with proper operation and maintenance practices are in the range of 12-15 percent.

Table 2: Projected Electricity and Heat Demand on KNEHC

Consumer Category	1990 Actual	1995 Estimate	2000 Forecast	Annual Growth 1995-2000 (%)
Domestic Electricity Sales (GWh)				
Industry	3,468	2,100	2,300	2.5
Agriculture	1,913	1,100	1,375	4.4
Residential	1,111	3,500	3,950	2.1
Others	1,152	1,100	1,375	4.4
Total	7,644	7,800	9,000	2.9
Heat Sales ('000 Gcal)				
Industry	2,097	360	450	5.7
Agriculture	197	150	160	1.6
Residential	1,894	1,660	1,840	4.1
Others	1,210	570	750	4.5
Total	5,398	2,740	3,200	3.5

28. The main objectives of the Government's post-independence energy policy have been (i) increased reliance on indigenous energy resources to reduce imports, (ii) restructuring of energy entities to increase their autonomy and self-sufficiency, (iii) attracting private sector participation to improve efficiency and mobilize finance, (iv) establishment of the legal and regulatory framework, (v) introduction of an energy pricing policy to encourage efficient use and sustain sector development while taking into account social objectives, (vi) promotion of energy conservation and use of renewable energy, and (vii) modernization and development of the sector's production capacity. Energy sector development programs are based on these objectives.

29. Restructuring of the country's energy sector to fit into a market economy is progressing, with assistance being provided by various members of the external aid community including USAID, the European Union, EBRD, IDA, and the Bank. An Action Plan prepared by IDA summarizes the main energy sector issues and recommended actions (see Appendix 2). The Action Plan serves as a focal point for coordinating external assistance and monitoring the progress of the adoption of reform measures. The recommended actions may be grouped into those required within the next year and a half, and the medium to longer term ones. The near-term recommendations include (i) improvement of energy policy, sector organization, and coordination; (ii) enhancing private involvement; (iii) restructuring and commercializing State-owned enterprises; (iv) adjusting energy prices and improving collections; (v) establishing targeted social safety net programs; (vi) preparing appropriate legislation and a regulatory framework; and (vii) improving regional trade arrangements. The medium and longer term measures under the Action Plan include continuation of the implementation of recommendations on (i) sector organization, private sector involvement, and institutional aspects; (ii) pricing, collection, and social safety net programs; (iii) adoption of legislation and regulatory directives; and (iv) trade arrangements.

30. In the short term the Government's strategy in the power subsector is to concentrate on supply and end-use efficiency improvements, including strengthening of the transmission grid. In the medium and long term, it sees the development of the hydroelectric

potential as a crucial means of meeting future electricity demand in the country, reducing the dependence on hydrocarbon imports, and increasing exports to the People's Republic of China (PRC) and Kazakhstan. KNEHC's own strategy in the short and medium term is to improve its collection efficiency, introduce business planning, and concentrate investments in transmission and distribution. In the longer term, it would like to complete the two Kambarata hydroelectric projects to enable greater power exports.

C. External Assistance to the Sector

31. So far, only two loans have been made by the international aid community to help develop the energy sector of the Kyrgyz Republic. In the Bank's Special Assistance Project,¹ \$4 million was allocated for the purchase of critically needed transformer substation equipment. In the second quarter of 1995, EBRD provided a loan of \$38 million (ECU31 million) to KNEHC to upgrade parts of its power transmission system and improve power supply reliability to support operations of the Kumtor gold mine in the Issyk Kul region, which is a significant source of export revenues for the country. All other external assistance has been in the form of technical assistance grants for advisory services and studies, many of which are still ongoing.

32. The Bank has been coordinating its operations in the Kyrgyz Republic's energy sector with other agencies, particularly the World Bank. The Bank, the World Bank, and EBRD are applying common financial covenants to KNEHC. In the preparation of the proposed Project, the two major cofinancing institutions, the Bank and the World Bank, have coordinated closely with USAID, the European Union, and EBRD.

D. The Bank's Sectoral Strategy

33. The Bank's interim operational strategy for the Kyrgyz Republic was formulated and approved in January 1994.² Facilitating the transition to a market economy is the principal objective of the interim operational strategy. In the near term this objective will entail (i) support to macroeconomic and sectoral policy reforms in close coordination with the World Bank and International Monetary Fund, (ii) institutional strengthening and human resource development, and (iii) selected sectoral infrastructure interventions in support of general economic growth and private sector development.

34. An overriding short-term concern is the generation of a flow of budgetary assistance and external resources. High priority will be attached to financial support that enables the immediate importation of essential inputs, raw materials, and consumer goods to revive production and avert widespread deprivation. Because of the effect of the reform process on vulnerable groups, the strategy will need to be cognizant of social safety net issues even though the immediate priorities are related to macroeconomic stabilization consistent with the goal of enhanced economic efficiency. Only by restoring macroeconomic stability and economic growth can poverty be reduced in the longer term. In the interim, Bank operations will focus on critical interventions that reflect both a targeted approach to the Bank's cross-cutting objectives and the Government's limited budgetary resources.

¹ Loan No. 1342-KGZ, for \$40 million, approved on 8 December 1994.

² *The Bank's Interim Country Operational Strategies in Kazakhstan and the Kyrgyz Republic* (Doc. 119-93).

35. Adverse environmental impacts that have resulted from the previous economic regime and structure will be addressed through policy advice, institutional strengthening including pollution monitoring and enforcement, environmental regulation of economic sectors including those of mining and infrastructure, and human resource development. Steps will also be taken to ensure that Bank-financed operations are planned and executed in a manner that minimizes adverse environmental impacts as well as costs of compliance with environmental regulations.

36. Bank financing of traditional project investments is likely to be constrained, at least over the next 2-3 years, by shortfalls in logistical and absorptive capacity and by severe limits on the availability of counterpart funds. Initial investment operations are likely to focus on physical infrastructure and human resource development that will support a restructured public sector investment program relative to the needs of the emerging private sector. The consideration of policy issues such as cost recovery, efficiency pricing, and enterprise reform will be an important feature of these operations. Investment operations, however, will be subject to the demarcation that has been agreed upon in principle with EBRD, under which, in the public sector, the Bank will cover social sector needs and take the lead in infrastructure projects, while EBRD will focus on foreign exchange-generating public sector projects and the private sector.

37. In the energy sector, the Bank's operational strategy is to support sectoral development through investment prioritization, energy conservation, and financial sustainability. Considering the transitory state of the economy and, consequently, of the demand for electricity both by the domestic market and by importing countries, long-range investment planning is difficult. The two major thermal cogeneration plants in the Kyrgyz Republic use imported fuels whose prices have increased rapidly in the past few years. Because the main equipment in these plants is aging, its rehabilitation and the application of more energy-efficient technologies will yield high economic returns. The low tariffs for power and heat do not provide sufficient incentives to conserve electricity, leading to high per capita electricity consumption. There is also a need to help KNEHC attain financial sustainability by improving collection efficiency and adjusting tariff.

E. Policy Dialogue

38. The Action Plan for Energy Sector Restructuring (Appendix 2) provides the basic recommendations concerning the main issues facing the Government and the concerned energy sector institutions. The Bank's agenda for policy dialogue is based on this Action Plan. Following are the key issues on which the Bank is focusing.

1. Electricity Trade Arrangements

a. Electricity Exchange with Kazakhstan

39. The Kyrgyz Republic and Kazakhstan exchange electricity based on annual agreements. KNEHC imports electricity from Kazakhstan during the night (off-peak period) and exports electricity during the day (peak period). KNEHC is a net exporter and the export price averaged about 2.7 US cents per kWh in 1995. This export price is not based on avoided cost considerations and has no differentiation between peak and off-peak electricity. The issue is further complicated by the requirement for the Kyrgyz Republic to manage its water resources to accommodate irrigation water demands of the neighboring countries during summer. Given

background, there is a need for further regional discussions based on a common approach to optimize operations of the regional power system and to value adequately electricity available for export and regulated water provided for irrigation. The Bank is in a position to facilitate such discussion since it is providing power subsector institutional assistance to both the Kyrgyz Republic and Kazakhstan.

b. Electricity Exports to PRC

40. Since 1992, KNEHC has been supplying a nominal quantity of electricity (above 5 GWh a year) to PRC via a 10-kV transmission line across the border to an isolated area in the Lindzen-Uygur province of PRC. Exports through this line have been priced at \$0.017/kWh. An understanding has now been reached to export larger quantities of electricity (50-80 GWh a year) through a new 220-kV line to the Kuzul-Sui and Kashgar regions of the Xinjiang Uygur Autonomous Region in the PRC. However, the Kyrgyz Republic needs to obtain a long term commitment for electricity export at equitable pricing. Recognizing this need, the Bank approved a regional technical assistance¹ to further explore the feasibility of increasing electricity exports to PRC and to address the international issues involved. Discussions among PRC, Kyrgyz Republic and the Bank are ongoing, and it has been agreed that the study will have to determine, among others, the likely annual energy demand, peak load, capital investments required, responsibility for capital works, and pricing arrangements.

2. Expanding the Market for Hydroelectricity

41. The Kyrgyz Republic has proven and established capability in planning, designing and implementing major hydroelectric power projects. There are a number of such projects in the Naryn River, such as the Kambarata projects, which are ready for implementation. As noted earlier (see para. 20), the absence of a strong export market for electricity is a major impediment to their implementation. Based on the experience gained in the study on the exports of power to the PRC, the Bank will be able to help the country pursue the enlargement of the export market and also the development of long-term purchase contracts that would facilitate implementation of the Kambarata projects.

3. KNEHC's Tariffs for Power and Heat

42. In July 1994, electricity tariffs were doubled but the increase was more than offset by the inflation over the past year; thus, the price of electricity decreased in real terms. As the prices of other forms of energy, except those for district heating and natural gas for households, were rapidly brought up to international market levels in 1994, the consumption of electricity by households has risen sharply. As of mid-1995, the tariff rate for the first 300 kWh of the monthly consumption of residential consumers was Som0.06(\$0.0055) per kWh, and that for industrial consumers was Som0.11(\$0.010) per kWh. These rates were just a fraction of the average market price levied by commercially oriented energy utilities in the Asian region (see Table 1). As explained earlier (see para. 11), the low electricity tariffs are leading to uneconomical consumption patterns with switching over to electricity from gas and coal for heating as the prices of these alternative fuels have increased in real terms. The average monthly electricity bill

¹ TA No. 5663-REG: *Kyrgyz Republic and Xinjiang Uygur Autonomous Region Power Development Study*, for \$360,000, approved on 21 December 1995.

of a Bishkek household was only about Som9.00, assuming consumption of 150 kWh (before the massive shift to the use of electricity for heating by residential consumers), and with this low utility expense on electricity, there was no incentive to economize on consumption. The tariffs for district heating were increased in July 1994, with the rate for domestic users being tripled. However, as of mid-1995, the rate of Som15(\$1.36) per Gcal of heat for domestic users was far below the cost of supply, and the rate of Som124(\$11.20) per Gcal for industrial users, while close to the cost of fuel, did not allow for rehabilitation or renewal of assets.

43. In view of the critical need to rationalize the tariff structure and levels, the Bank has provided technical assistance to revalue KNEHC's assets and establish tariff setting procedures¹. The study under the technical assistance will include: (i) an inventory of the fixed assets that are under the control and supervision of KNEHC and are used in energy-related activities; (ii) determination of their fair present value; (iii) development of a methodology for asset revaluation; (iv) development of appropriate power and heat tariff setting procedures considering cost structure and social impacts; (v) development of appropriate procedures for periodic review and updating of tariffs; and (vi) the related training of KNEHC staff.

44. The Government and KNEHC have agreed during the processing of the Project to take steps towards the reform of the tariff setting procedures, structures and levels. As an intermediate measure, the electricity and heat tariffs are being adjusted through two-step increases in 1996 to enable revenues during the year to cover all cash operating expenses.² At the completion of the revaluation study by the end of 1996, KNEHC will endeavor to reflect the value of revalued assets into its accounting system. KNEHC will then use the recommendations resulting from the tariff study to further adjust tariffs in 1997 so that its revenues in that year cover all operating expense including depreciation. Starting from 1998, KNEHC will implement tariffs that will enable it to generate annual self-financing ratios not lower than 30 percent.

4. Institutional Reforms

45. The power and heat sector in the country has been operated by a single vertically integrated entity for more than 30 years. KNEHC currently has a joint-stock holding company status, although it is still virtually wholly-owned by the Government. There is a need to pursue its restructuring to promote more efficient sectoral development and possible privatization. The unbundling of generation, transmission and distribution activities should be among the restructuring options to be considered. Under the Project, a long-term strategy for restructuring the power and heat sector and opening it to private investment will be developed (see para. 53). The Project also includes the provision of support to KNEHC in improving its billing and collection system to make it appropriate for a commercially oriented utility. Other measures being taken for KNEHC's institutional strengthening include (i) the above-mentioned Bank assistance for the asset revaluation and tariff setting study, (ii) EBRD assistance for the

¹ TA No. 2542-KGZ: *Revaluation and Tariff Study for KNEHC*, for \$310,000, approved on 13 March 1996.

² In April 1996, the electricity tariffs were raised to Som0.09 per kWh for residential consumers and Som0.18 per kWh for industries while the heat rates were increased to Som60 per Gcal for residential consumers and Som248 per Gcal for industries. This will be followed by another round of increases in July 1996, which has already been approved and notified by the Government, and which will bring up the tariffs to Som0.17 per kWh and Som120 per Gcal for residential consumers, and to Som0.21 per kWh and Som248 per Gcal for industries.

establishment of a commercial management system, and (iii) European Union assistance for general management improvement and training activities.

IV. THE PROJECT

A. Rationale

46. Reliable and efficient power and heat infrastructure is an important basic requirement for the macroeconomic stabilization and economic transformation efforts of the Government. Given the urgent need to overcome power and heat supply constraints and to increase the efficiency of supplying and utilizing energy, priority is being given in the short-term to retrofitting and rehabilitating existing energy facilities. The Project will involve rehabilitation of the thermal cogeneration plant in Bishkek, rehabilitation of district heating facilities in Bishkek, rehabilitation and reinforcement of power transmission and distribution facilities throughout the country, and provision of assistance for strengthening of operational and management capabilities of KNEHC. The Project Framework, shown in Appendix 3, indicates how the Project's outputs, activities, and inputs relate to its goals and objectives.

47. The Project is in full consonance with the Bank's interim operational strategy for the Kyrgyz Republic with its focus on upgrading the basic infrastructure necessary to support economic growth. Some aspects of the Project that are in line with the Bank's country strategy include (i) contributing to economic recovery by improving energy supply reliability; (ii) enabling savings in fuel imports; (iii) institutional strengthening and human resource development in the power and heat sector; and (iv) close donor coordination in seeking policy reforms, including, in particular, tariff adjustment and energy sector legislation. By improving district heating facilities, the Project also addresses a basic human need of the majority of the residents of Bishkek. The district heating system which gets steam and hot water from the Bishkek TES1 plant is the only source of heating during winter for 60 percent of the city's population. If the present deterioration of the TES1 plant and the district heating system is allowed to continue, there is a serious risk of a breakdown. Given the present overloading of the power transmission and distribution system, it would not be possible to meet the demand through electrical heating only.

B. Objectives and Scope

48. The primary objective of the Project is to support economic growth in the Kyrgyz Republic through rehabilitation and upgrading of the power and heat supply infrastructure. Other objectives of the Project include (i) improvement of power and heat system efficiency and reliability, (ii) reduction of energy losses, (iii) reduction of adverse environmental impact, (iv) extension of the economic life of existing assets, and (v) contribution to the attainment of financial soundness and implementation of institutional strengthening measures.

49. The scope of the Project is summarized below and described in more detail in Appendix 4.

1. Part A: Bishkek Thermal Energy Station Rehabilitation

50. Seven old boilers that have been selected will be refurbished together with selected turbine components. A 90-MW steam turbine (Turbine No. 11) that has been received from Russia and held in storage since 1993 will be installed together with a generator that will be procured. Plant instrumentation and control systems will be upgraded, and essential auxiliary systems such as coal supply, make-up water, and compressed air will be retrofitted. Monitoring devices for emissions such as sulfur dioxide and nitrogen oxides will be installed, and a nondestructive metal testing laboratory will be provided.

2. Part B: District Heating Rehabilitation

51. The district heating network in Bishkek will be rehabilitated through the replacement of the most dilapidated network sections with preinsulated pipes (about 13 km) to eliminate leaks and reduce corrosion. Damaged and poor insulation of the aerial sections of the network (about 7 km) will be replaced. The district heating system will be modernized by making the system capable of variable flow operation through the installation of frequency converters on selected pumps and an automatic control system necessary to optimize the benefits of variable flow operation. Also the substations will be upgraded to adapt to variable flow operation; energy control valves and meters will be installed.

3. Part C: Power Transmission and Distribution Reinforcement

52. High priority reinforcement and rehabilitation work required on key substations in the power transmission and distribution system will be carried out and control equipment will be provided to reduce system losses and to improve system reliability. Essential equipment in 12 selected substations throughout the country will be retrofitted, selected substations will be rehabilitated and two new 220/110-kV substations will be constructed to improve bulk power supply, (one in Ala-Archa near Bishkek and another in Naryn). About 100,000 electricity meters will be installed to help improve the billing and collection operations of KNEHC.

4. Part D: Technical Support and Training

53. This part provides assistance for Project implementation and for strengthening KNEHC's general and financial management. The assistance will include (i) advisory services to the Project Implementation Unit (PIU) in the areas of project management and contract management; (ii) conduct of a study on improvement of KNEHC's billing and collection, and implementation of study recommendations; (iii) conduct of a power/heat sector structure organization and management study; (iv) a petroleum exploration promotion study; and (v) training. The assistance on billing and collection will provide for the installation of consumer accounting systems and procedures that would promote commercially oriented utility operations. The organization and management and structure will help the Government to develop an overall strategy for restructuring the power and heat sector with the view to improving sector efficiency, reducing drain on the national budget, and paving the way for private sector involvement. The petroleum exploration promotion study will develop a promotional strategy and prepare data packages required for attracting potential investors in petroleum exploration in the country. The training activities under the Project will assist KNEHC in developing a continuing training program in the areas of personnel management, financial management, power system planning, and project management.

C. Technical Justification

54. The general condition of TES1 and its associated district heating network is poor because of aging and a lack of adequate maintenance. Rehabilitation of seven selected boilers and other equipment is necessary to improve the adequacy, reliability, and efficiency of heat and electricity production. The steam turbine (No. 11), which has been lying in storage since 1993, is in good condition; it will be installed with the associated generator and auxiliaries to provide 90 MW of capacity at minimal cost and to allow the phasing out of two oldest units (Turbines Nos. 1 and 2) before the year 2000. Equipment for vibration monitoring and nondestructive examination will enable improved planned maintenance as well as effective replacement scheduling. Other instruments and control meters will enable improved plant efficiency and operations control. Environmental monitoring equipment will be installed to improve the monitoring of plant emissions and allow better control of boiler operation resulting in reduced emissions. A summary of the benefits accruing from the various Project components is given in Appendix 4.

55. The required district heating rehabilitation works include the replacement of damaged and poor insulation of aerial transmission pipes and replacement of some other dilapidated pipe sections. These works are necessary to reduce the heat losses in transmission from the present 25 percent of total heat produced to about 15 percent, which is the standard in similar systems in other countries. In addition, heating substations will be rehabilitated and variable flow capability will be introduced to better control the district heating system; this will include the installation of an automatic control system and energy meters. The present constant flow operation does not allow for customized regulation of steam and hot water flows in the various parts of the heat distribution network and results in heat losses. The substation rehabilitation and variable flow capability will result in (i) load dispatch responsive to demand, (ii) increased network capacity, (iii) reduced energy consumption, (iv) reduced temperature differentials, and (v) reduced coincident demand.

56. The power transmission and distribution system suffers from overloading, and urgent rehabilitation is needed to prevent further overloading and even system collapse. The reinforcement and rehabilitation works on the transmission and distribution system are parts of a least-cost reinforcement program to reduce technical losses and maximize the reliability of KNEHC power system operation. The construction of the Ala-Archa substation and the reinforcement of the Chuikaia substation will reduce the risk of serious blackout for Bishkek as well as system losses. The construction of the new substation at Naryn will improve the reliability of the power supply in the area around Issyk Kul Lake and the city of Naryn. The acquisition of new larger transformers for substations under the Project will reduce the risks of electricity outages in the surrounding areas and allow redeployment of replaced transformers to other substations. The improved district heating system in Bishkek, together with appropriate electricity tariff increases, is expected to reduce the pressure on the heavily loaded electrical transmission and distribution system.

57. KNEHC is particularly weak in project implementation capability. The technical support and training component will assist the utility to build up its expertise in project management including project preparation, construction supervision, and project financial management. Also, KNEHC's move towards more commercialized operation will be assisted under the Project.

D. Cost Estimates

58. The Project is estimated to cost \$98.4 million equivalent, of which \$72.4 (74 percent of total cost) is foreign exchange cost and \$26.0 million equivalent (26 percent) is local currency cost. The cost estimates are summarized in Table 3; details are shown in Appendix 5.

**Table 3: Summary of Project Cost Estimates
(\$ million)**

Component	Foreign Exchange	Local Currency	Total Cost
Part A. Bishkek TES1	14.6	3.3	17.9
Part B. District Heating	20.1	5.5	25.6
Part C. Transmission and Distribution	22.8	2.8	25.6
Part D. Technical Support and Training	3.7	0.4	4.1
Base Cost	61.2	12.0	73.2
Contingencies	9.9	4.3	14.2
Interest During Construction	1.3	9.7	11.0
Total Project Cost	72.4	26.0	98.4

E. Financing Plan

59. The financing plan for the Project is summarized in Table 4; details are shown in Appendix 5. The proposed sources of financing for the foreign exchange costs include the Bank (\$30 million or 30 percent of the total Project cost); IDA (\$20 million or 20 percent); DANIDA (\$8.6 million equivalent or 9 percent); NDF (\$6.8 million equivalent or 7 percent); and the Swiss Government (\$4.5 million equivalent or 5 percent). The Bank loan would finance 71 percent of the foreign exchange costs for Part C: Power Transmission and Distribution Reinforcement and 48 percent of those for Part B: District Heating Rehabilitation. The IDA loan would finance all foreign exchange costs of Part A: Bishkek TES1 Rehabilitation excluding Turbine No. 11 and Part D: Technical Support and Training; the DANIDA credit would finance part of Part B; the NDF credit would finance parts of Parts B and C; and the Swiss Government grant would finance the foreign exchange costs of the new substation in Naryn under Part C. The Government will cover the cost of Turbine No. 11 (\$2.3 million) and all service and interest charges during construction (\$1.3 million in foreign exchange and \$9.7 million equivalent in local currency), while KNEHC will cover the balance of local currency costs (\$15.2 million equivalent or 15 percent of the total Project cost).

60. The Bank loan of \$30 million equivalent, denominated in Special Drawing Rights, will be from the Bank's Special Funds resources and would have a repayment period of 40 years including a grace period of 10 years and a 1.0 percent service charge per annum. The Government will relend the Bank loan proceeds to KNEHC at an annual interest rate equivalent to the Bank's lending rate for multicurrency loans from its ordinary capital resources, with the

foreign exchange risk borne by the Government, and a repayment period of 15 years including a 4-year grace period.

**Table 4: Financing Plan
(\$ million)**

Source	Foreign Exchange	Local Currency	Total Cost	Percent of Total
Bank	30.0	0.0	30.0	30
IDA	18.9	1.1	20.0	20
DANIDA	8.6	0.0	8.6	9
NDF	6.8	0.0	6.8	7
Swiss Government	4.5	0.0	4.5	5
KNEHC	0.0	15.2	15.2	15
Government	3.6	9.7	13.3	14
Total	72.4	26.0	98.4	100

61. The IDA loan would be denominated in Special Drawing Rights and would be provided with a service charge of 0.75 percent per annum with 35 years maturity and a 10-year grace period. The DANIDA credit would be provided at no interest with a repayment period of about 8-9 years after the implementation period. The NDF credit would be on terms including a maturity period of 40 years with a 10-year grace period and a 0.75 percent service charge. The Swiss funding for the Project would be provided as a grant. To facilitate coordination among the various cofinanciers, the relending terms for proceeds from the various grants and loans for the Project will all have the same terms and conditions (except that the relending rate of the IDA loan will be equivalent to the World Bank's variable lending rate).

F. Implementation Arrangements

1. Project Implementation

62. KNEHC will be the Executing Agency for the Project. A Project Implementation Unit (PIU) will be set up to carry out procurement operations, coordination, reporting, and disbursement for all components. The PIU will be headed by a Project Manager, appointed by KNEHC, who will have qualifications acceptable to the cofinanciers. The organization chart for the PIU is shown in Appendix 6. The Project Manager will be assisted by Project implementation consultants in the conduct of various project management, procurement, construction supervision, and training activities. All Project components are scheduled to be completed by the end of 1999. The implementation schedule is given in Appendix 7.

2. Procurement

63. All goods and services required for the Project and financed by the Bank will be procured in accordance with the Bank's *Guidelines for Procurement*, while those financed by IDA

will be procured in accordance with the World Bank's *Procurement under IBRD Loans and IDA Credits (January 1995)*. Other cofinanced contract packages will be awarded using the procedures of the cofinanciers concerned. The tentative contract packaging is given in Appendix 8.

3. Consulting Services

64. Consulting services will be required in the implementation of all Project components, particularly for providing project management services, assistance in the review of engineering designs, tendering, supervision of installation, and testing and commissioning of equipment. Also, consulting services will be required for on-the-job technical support and training in implementing system maintenance procedures as well as for operating monitoring equipment. A total of about 118 person-months of international consultant input will be required for various consulting contract packages (excluding the studies under Part D) including (i) 20 person-months for Part A by experts in rehabilitation or refurbishment of thermal cogeneration plants, (ii) 20 person-months for Part B by experts in rehabilitation of district heating and thermal cogeneration plants, (iii) 30 person-months for Part C by experts in power transmission and distribution systems, (iv) 40 person-months for overall project coordination under Part D by experts in project management and contract management, and (v) 8 person-months by training experts. A total of 60 person-months of domestic consultant input will be required to assist in overall project coordination under Part D. The 50 person-months of international consultant input under Parts B and C will be financed by the Bank and recruited in accordance with the Bank's Guidelines on the Use of Consultants. The other consultants will be recruited in accordance with the procurement guidelines of the cofinancier concerned. The terms of reference for the consulting services for implementation assistance are shown in Appendix 9.

65. Consulting services will also be required for three studies under Part D of the Project including (i) billing and collection improvement (about 38 person-months of international consultant input requirements); (ii) sector structure, organization, and management study (about 40 person-months of international consultant input requirement); and (iii) petroleum exploration promotion study (consultant input requirement will be determined later). The indicative terms of reference for the first two studies are shown in Appendix 10; those for the petroleum exploration promotion study are available on request.

4. Reports, Accounts, and Audit

66. KNEHC has agreed to prepare quarterly reports on the progress of Project implementation and to furnish the Bank with copies of these reports. Within three months of the completion of the Project, KNEHC will furnish the Bank with a Project completion report covering the details of implementation and such other information as may be required by the Bank. KNEHC will maintain separate records and accounts in respect of Project expenditures and will have such accounts audited annually by independent auditors acceptable to the Bank. Copies of the audited Project accounts will be provided to the Bank within six months after the end of each relevant fiscal year. KNEHC will also provide the Bank with copies of its audited corporate financial statements within 12 months of the end of the fiscal year.

5. Advance Recruitment Action

67. To facilitate timely implementation of the Project, the Bank has approved advance action for the recruitment of consulting services for implementation assistance under Parts B and C. The Government is aware that approval of such advance recruitment action does not commit the Bank to finance the Project.

G. The Executing Agency

1. Kyrgyz National Energy Holding Company

68. KNEHC is the utility responsible for the generation, transmission, and distribution of electricity and heat in the country. Before 1991, the entity reported directly to the Ministry of Energy of the Soviet Union; in January 1994, it was converted into a State-owned joint stock company. KNEHC comprises 16 enterprises involved in power and heat supply functions; its organization structure is shown in Appendix 11. A Head Office in Bishkek administratively coordinates the operations of the field enterprises. Overall responsibility for day-to-day operations is the responsibility of the President, who is assisted by two Vice Presidents. KNEHC has a total of about 15,000 employees. Considering that there are about 870,000 power and/or heat consumers, there is room to improve the consumer/employee ratio.

2. Financial Management

69. Financial books of KNEHC are kept in accordance with accounting systems that were in effect prior to independence. Many current financial management practices are not in accordance with internationally accepted practices; this makes management and financial performance under a market-oriented economy difficult to assess and control. The European Union, EBRD, and USAID have been providing technical assistance to KNEHC related to improvement of its management structure, including the development and implementation of a modern commercial accounting system, which is targeted to be operational by the end of 1996.

3. Past Financial Performance

70. Until 1991, the financial operations of KNEHC as a department of the Ministry of Energy of the Soviet Union were largely under a protected environment. Tariffs were uniform throughout the former Soviet Union, and fuel costs were artificially lower than world prices. Any financial surpluses were turned over to the government, which, in turn, financed all investment requirements. In KNEHC's books, there are no long-term debts to date.

71. An analysis of KNEHC's recent past financial performance is complex considering that inflation rates have been high (1,300 percent per year in 1992 and 1993); accounting practices do not follow international standards; and the Kyrgyz currency, the som, was introduced only in May 1993. In the financial statements of KNEHC for 1993 and 1994, the following aspects are notable:

- (i) Power operations fully recovered all cash operating expenses with some surplus. In the heating sector, operating revenues covered only about half of cash operating expenses.

- (ii) Fuel costs increased sharply when oil and coal prices were increased to international levels by the exporting countries.
- (iii) Fixed assets are considerably undervalued.
- (iv) With no long-term debts, interest expenses are minimal. This is one reason for the relatively low total operating costs.
- (v) Accounts receivable have been a critical problem.
- (vi) Cash generated internally is insignificant in comparison with envisaged capital expenditure plans.

72. KNEHC incurs fuel expenditures for the cogeneration plants in Bishkek and Osh and two small cogeneration plants in Kyzyl Kia and Kara Kul. It imports coal, fuel oil, and natural gas to operate these plants. Import prices for fuel oil and natural gas are about 81-94 percent of the average international price, while those for coal are in the range of 80-107 percent. While fuel costs comprised only 23 percent of operating costs in 1991, these rose to 44 percent in 1993.

73. KNEHC partially revalued its fixed assets in 1993, but its fixed assets still totalled only about \$37 million as of the end of 1994, whereas a utility with a generating capacity of 2,740 MW from hydropower plants and 659 MW from cogeneration plants plus about 70,000 km of transmission lines should typically have fixed assets with a gross value of about \$3.5 billion. The immediate implication of this asset undervaluation is the failure of tariffs to account for the recovery of capital costs. As indicated earlier (see para. 43), the Bank is providing technical assistance to KNEHC for the revaluation of its fixed assets to help provide a basis for appropriate tariff setting as well as to lay the foundation for any privatization measures it may take in the future. KNEHC has given the assurance that it will reflect the revaluation study results in its accounting system.

74. As of the end of 1994, the accounts receivable of KNEHC for electricity sales, amounting to about Som770 million or \$70 million, were equivalent to 7.5 months of billings; in district heating sales, accounts receivable amounting to about Som65 million or \$5.9 million were equivalent to 6 months of billings. Receivables from Government agencies were particularly onerous. In mid-1995, KNEHC got Government approval to offset arrears related to Government agencies amounting to Som141.9 million (about \$13.5 million equivalent) against its tax liabilities. Still, accounts receivable as of late 1995 amounted to about Som660 million or 5.9 months of billings.

75. Overall, while the utility does not appear to have made book operating losses in the past, low levels of tariff, depreciation, high taxation, rising fuel prices, and rising receivables are crippling its ability to generate cash and meet its capital investment requirements. During the first half of 1995, revenues from exports of electricity to Kazakhstan were reduced drastically with the slowdown of Kazakhstan's economy and its problems in settling its import bills with foreign exchange; however, later in the year, a deal was made to export electricity, in addition to a steady supply of irrigation water during summer, in exchange for gas, oil, and coal.

4. Projected Financial Performance

76. Projections of KNEHC's financial operations are based on agreements with the Government and KNEHC to implement the following measures: (i) KNEHC will take all necessary actions, including the implementation of tariff adjustments, to ensure that revenues will (a) cover

cash operating expenses in 1996, (b) cover all operating expenses including depreciation in 1997, and (c) enable annual self-financing ratios not lower than 30 percent starting in 1998; and (ii) KNEHC will take steps to reduce total accounts receivable to the equivalent of about 2.0 months of billings by the end of 1997. In determining the tariff adjustments, the recommendations and findings of the Bank-financed technical assistance for KNEHC asset revaluation and tariff study will be taken into account. The tariff adjustments include (i) the elimination of the cross-subsidies benefitting households at the expense of other users, and (ii) the indexation of tariffs to the rate of inflation and the cost of fuels.

77. Once these measures are implemented, KNEHC's financial performance is expected to improve gradually. The financial projections are summarized in Table 5 and presented in detail in Appendix 12. The tariff increases in 1996 will effectively increase domestic electricity tariffs by 78 percent over those in 1995, and heating tariffs by about 127 percent. From 1997 to 2000, electricity tariffs need to be increased by an average of about 35 percent each year, and heating tariffs by about 12.6 percent per year. These tariff increases are considered reasonable considering that the average tariffs by the year 2000 would be about Som0.486/kWh (\$0.046/kWh) in current prices or Som0.255/kWh (\$0.041/kWh) in 1995 prices for electricity, and Som234/Gcal (\$20/Gcal) in current prices or Som122/Gcal (\$18/Gcal) in 1995 prices for heat.

**Table 5: Summary of KNEHC's Past and Projected Financial Performance
(Som million)**

Indicator	1993 Actual	1994 Actual	1995	1996	1997	2000	2002
Domestic electricity sales (GWh)	7,988	7,830	7,800	8,000	8,200	9,000	9,550
Export electricity sales (GWh)	1,023	2,505	1,486	1,500	1,510	1,535	1,540
Heat sales ('000 Gcal)	3,967	2,698	2,740	3,100	3,300	3,200	3,200
Average revenue							
Electricity (Som/kWh)	0.023	0.067	0.083	0.148	0.221	0.486	0.486
Increase (%/year)		191	24	78	50	30	0
Heat (Som/Gcal)	16	46	61	138	207	222	234
Increase (%/year)		188	31	127	50	2	3
Operating income (Som million)	222	437	-182	-283	0	2,173	2,354
Return on net fixed assets (%)	117.6	156.5	-55.3	-3.5	-0.4	6.7	7.4
Self-financing ratio (%)			-59	-20	163	251	351
Accounts receivable (months)	9.9	7.4	5.9	4.0	2.0	2.0	2.0
Capital expenditures							
Rehabilitation (Som million)				121	345		
Other projects (Som million)			171	597	486	1,179	732
Debt-service ratio			-13.9	6.3	19.5	15.7	17.6
Depreciation (Som million)			13	499	1,013	1,183	1,293

78. It may be noted that from 1997 onwards, the self-financing ratios are well above 30 percent. This is due mainly to the current conservative estimates by KNEHC of long-term development projects. For the five-year period 1996-2000, the capital investment requirements

total only about \$350 million in addition to those under the Project. Should the long-term development plan be expanded later to respond to the needs of an expanding economy, the self-financing ratios could be lower than as presently projected. For example, should the proposed Kambarata 1 project be implemented starting in 1997, the self-financing ratio could be in the range of 20-30 percent up to 1999. The accounts receivable, which were equivalent to about 5.9 months of billings in 1995 are targeted to be brought down to an equivalent of 4 months of billings by the end of 1996, and to 2 months of billings by the end of 1997. This will require KNEHC's strict implementation of billing and collection reforms, measures related to utility bill payments by Government offices and enterprises, and other financial management and operational improvements.

H. Environmental and Social Measures

1. Environmental Measures

79. Improvement of the efficiency of the cogeneration plant and the district heating network in Bishkek will indirectly improve the environment. The Project will result in a reduction of the amount of fuel, and the consequent emissions, required to produce the same quantity of energy to satisfy demands for power and district heating. It is estimated that the emission of nitrogen oxides will be reduced by 20 percent, sulfur dioxides by 8 percent, and carbon dioxide by 15 percent. A component of the Project that will directly result in reducing the environmental impact of the KNEHC's operations involves the installation of monitoring devices for emission of air pollutants. This will allow the operating staff to take measures to reduce emissions. The reduction in leakage through replacement of dilapidated pipe sections will reduce water losses and thereby reduce the use of chemicals in the treatment of make-up water.

80. An initial environmental examination was carried out for the Project (see summary in Appendix 13); its findings indicate the positive effects on the environment and the recommended measures will mitigate any potential negative impacts. The potential negative environmental impact from toxic and hazardous materials that could result from closure, disposal, or recycling of decommissioned equipment and facilities under the Project has been duly studied. With regard to the decommissioning and disposal of boilers and district heating piping insulated with asbestos fibers, KNEHC has agreed to provide the workers with safety and protective equipment during dismantling and handling of equipment containing asbestos. Likewise, KNEHC will rehabilitate the site prior to the installation of new equipment and dispose of the debris, excavated materials, and replaced equipment in a secured landfill after proper labelling, packing, and sealing. No polychlorinated biphenyl (PCB) will be used in any of the electrical equipment in the power house, or substations. The water conditioning system will not use any heavy metal dispersant or surfactant. KNEHC has agreed to institute corrective measures to improve the overall environmental quality of the Project site, particularly improvement of the treatment system for oily wastes, the operation and maintenance of the ash pit, and the monitoring program for air and water quality.

81. KNEHC has given the assurance that the Project will at all times conform with internationally acceptable environmental and safety standards. Specifically, the following will be ensured: (i) no PCB, asbestos, or toxic compounds will be used for the Project facilities; (ii) materials contaminated with such compounds will not be reused or recycled but will be disposed of in a secured landfill; and (iii) training and proper equipment will be provided to personnel concerned in the decommissioning of materials contaminated with asbestos.

2. Social Measures

82. As discussed earlier, there is a need to increase electricity and heat tariffs. Required increases for residential consumers will be particularly high. Low-income households, which are already facing considerable difficulties in paying their energy bills, especially for coal and petroleum products, priced at international levels, and for natural gas, priced close to cost-recovery level, will be particularly affected. A subsidized lifeline electricity tariff will be used as an interim measure, as low-income groups adjust to higher costs of living. An initial tariff of Som0.15/kWh for the first 100 kWh of electricity consumed per month by households is considered practical. In addition, given the cold winters in the Kyrgyz Republic, provision of some form of heating to households is a basic need. To address this, a targeted subsidy for low-income households for heating fuels, namely coal in rural areas and district heating or natural gas in urban areas, is required.

83. A social safety net program is proposed to alleviate the impact of higher fuel costs on low-income users of district heating, hot water, natural gas, and coal (see Appendix 14). For consumers connected to the district heating, hot water and natural gas networks, the subsidy will be based on the principle that household expenditure on energy utilities should not exceed 30 percent of household income. For paying for energy expenditures over this 30 percent ceiling, low-income users would receive subsidies in the form of vouchers that can be used to pay energy utility bills. It is estimated that about 70,000 of the 200,000 residential district heating consumers would be eligible for the subsidy. In the case of natural gas users, about 20,000 households would be eligible for the subsidy. For coal users, the subsidy would cover the purchase of the equivalent of one ton of coal per eligible household per year. About 175,000 rural households and 21,000 urban households will benefit from such a coal subsidy program.

84. The Government has indicated that it is likely to designate the Ministry of Labor and Social Protection to be charged with the implementation of the energy social safety net program, since this Ministry is currently administering other subsidy programs aimed at low-income groups. Eligible households would include those already eligible for monthly income support, including low-income families with children and pensioners (numbering about 265,000 households or 26 percent of the population). Provision of the subsidy could be through a voucher system, wherein use of the voucher is limited to purchasing coal or paying heating and gas bills. It is estimated that the safety net program would annually cost the Government about Som56 million for the district heating consumers, Som16 million for natural gas consumers, and Som78 million for coal users. The Government is considering the option to mobilize financing for the total subsidy of Som150 million per year, through an incremental tax on gasoline, which would raise retail prices by about 12 percent over the current retail price of Som3.20/liter (\$0.30/liter equivalent). The Government is preparing an action plan to establish the safety net program related to the electricity and heat tariffs. The Government will also begin to phase out discounts given to special categories of consumers of KNEHC (such as war veterans, military men, disabled persons, pensioners, and Government employees in the energy sector) by 1 July 1997.

V. PROJECT JUSTIFICATION

A. Financial and Economic Analyses

1. Benefits and Beneficiaries

85. Of the Project's capital investment in physical works, 26 percent will be spent on the rehabilitation and upgrading of TES1. This will result in improved boiler capacity and efficiency, increased power generation capacity (90 MW) and district heating capacity, phasing out of the old Turbines nos. 1 and 2, improved maintenance and replacement scheduling, improved plant emissions control, improved plant efficiency, and improved plant availability and reliability during peak winter time. About 37 percent of the Project investment in physical works will be for district heating rehabilitation. This will result in reduced system losses, better load dispatch, increased network capacity, reduced power consumption, and reduced flow temperatures. The power transmission and distribution reinforcement will account for the remaining 37 percent of the Project investment. This will result in reduced serious blackout risks in and around Bishkek, overall improved national grid system reliability, elimination of transformer overloads, and improved end-user energy conservation. In general, the Project will support economic development and provide the following direct benefits: (i) reduced power, water, and heat losses (with savings of about \$9.0 million in imported fuel per year); (ii) increased effective capacity to supply and deliver power and heat; (iii) reduced power outages (with estimated economic cost savings of about \$6.8 million per year) and improved voltage stability; (iv) improved dispatching of heat to consumers (estimated reduction of consumer demand by 5 percent); (v) reduced operation and maintenance costs (estimated at \$2.3 million per year); and (vi) extended life of the rehabilitated assets. The technical support and training component will enhance project management capabilities within KNEHC.

86. Since the country is almost 100 percent electrified, the Project will directly benefit the whole population of the Kyrgyz Republic in terms of a more adequate and reliable power supply. The Project will also directly benefit the residents of Bishkek in terms of an expanded network and a more reliable and responsive district heat supply.

2. Need for the Project

87. The Project is essential to rationalize and improve the energy supply in the country. Without the Project, the TES1 plant and the Bishkek district heating system will continue to deteriorate. The output from the TES1 plant will be insufficient to balance the northern power grid, leading to serious overloading of the main transformers that bring in power supply from the hydroelectric plants located outside the region. The Bishkek heating system capacity will continue to decline and may even collapse in some areas, further overloading the power transmission and distribution system as consumers use more electrical energy for heating purposes. Added to this is the serious economic distortion of energy prices, where very low electricity prices actually encourage the use of electricity for space heating in areas without access to district heating, rather than the traditional fuel sources like coal or natural gas. In economic terms electricity is three times more expensive for space heating than coal or natural gas. But in financial terms, the prices of coal and natural gas for this purpose are significantly higher than the price of electric heating (see Table 6) because of the unrealistically low electricity tariffs. This situation of subsidized electricity tariffs not only has a high economic cost, but is also causing serious overloading of the power transmission and distribution network.

88. The project, therefore, focuses on the rehabilitation of TES1 and the Bishkek district heating system to improve heat supply using efficient combined heat and power production rather than electric heating. Power generation and transmission facilities, which have been strained with the new consumption patterns, will be upgraded and reinforced. Policy dialogue has emphasized the need for electricity tariff level increases in line with cost of supply.

Table 6: Space Heating Cost Comparison

Indicator	Financial Fuel Price (\$/Gcal)	Economic Fuel Price (\$/Gcal)	Conversion Efficiency (%)	Financial Fuel Cost Per Effective Gcal of Heat (\$/Gcal)	Economic Fuel Cost Per Effective Gcal of Heat (\$/Gcal)	Capital Investment for Bishkek (\$ mn)
Electricity	6.6 ^a	29.1	98	6.7	29.7	400
Natural gas	11.5	9.4	75-85	13.5-15.3	11.1-12.5	165
Coal	7.6	8.6	65-80 ^b	9.5-11.7	10.8-13.2	43 ^c

^a Export price.

^b Range reflects individual boilers and centralized heat-only boilers.

^c Assumes rehabilitation of TES1 and district heating facilities.

3. Part A: Bishkek TES1 Rehabilitation

89. TES1, as the only major power generating station in the northern part of the Kyrgyz Republic, plays a key role in the balancing of the power supply of the region and the country as a whole; it is also the main supplier of the Bishkek district heating network and supplies heat and power at significantly lower cost and higher efficiency than heat-only boilers and power-only coal-fired thermal stations (see Appendix 15, Table 2). As such, the rehabilitation of TES1, focusing on priority, high-return areas, is clearly a least-cost activity.

90. The component comprises refurbishment of seven boilers, installation of a 90-MW turbine generator, upgrading of instrumentation and controls, and supply of other plant equipment. The main benefits of TES1 rehabilitation include increased capacity; improved plant efficiency; availability, and reliability; reduced environmental impact (emissions and ash handling); and life extension (see Table 7).

91. A 20-year simulation of system operation with and without the rehabilitation was carried out during the feasibility study; the findings indicated very high rates of return — greater than 40 percent. The economic and financial internal rates of return were estimated using the standard Bank approach, over the life extension period of 15 years. The analysis and assumptions are set out in Appendix 15, Table 4. Only the benefits of operating and maintenance cost savings and fuel cost savings from improved boiler and turbine efficiency were included. Because of the uncertainty of future load growth, additional savings due to increased heat and power capacity provided by the new turbine generator were not considered in the analysis. The financial and economic internal rates of return are estimated to be both on the order of 23-24 percent, which is considered favorable.

Table 7: TES1 Rehabilitation Benefits

Item	Unit	Without Project	With Project	Change	Percentage Change
Electrical capacity	MW	558	648	+90	+16
Heat and steam capacity	Gcal/hr	758	914	+156	+21
Boiler efficiency	%	87.5	89.5	+2.0	+2
Operating costs	\$million/yr	13.9	12.1	-1.8	-13
Fuel consumption	Tcal/yr ^a	7,820	7,470	-350	-5
Availability	%				+10 to +12
Environmental impact	t coal/yr	1.47	1.38	-0.09	-5

^a Tcal = teracalorie

4. Part B: District Heating Rehabilitation

92. The Bishkek district heating system supplies heat and hot water to over half of the city's population, and steam to various industries. An assessment of alternative means of meeting the city's heating needs was carried out during the feasibility study to address the issue of whether to rehabilitate the existing system or replace it. For electrical resistance heating, investment costs in transmission and distribution capacity only (excluding generating capacity) would be about \$400-600 million; and the economic energy cost would be three times that of using coal or gas to generate heat. In the case of decentralized natural gas heating, investment costs in the gas network to bring sufficient gas at adequate pressure to the consumers would be about \$165 million. Rehabilitation of TES1 and the existing district heating system (base cost of \$43.3 million) is the least-cost alternative as shown in Table 6.

93. The findings of the 20-year simulation of system operation with and without district heating system rehabilitation, carried out during the feasibility study, indicated economic returns of 20-25 percent depending on the assumed expansion of the network. To confirm the results of the simulation, Bank standard viability analysis was undertaken (Appendix 15, Table 5) considering the following benefits: (i) net operation and maintenance cost savings, (ii) system loss reduction, and (iii) consumer wastage reduction. The financial and economic internal rates of return were estimated to be 17 and 26 percent, respectively, which are considered favorable.

94. The component comprises replacement of 20 km of main piping, insulation replacement, and introduction of variable flow operations including necessary modernization of substations. At present the district heating system operates on a constant flow regime with variation of the hot water temperature at the power station. The main benefits of district heating system rehabilitation include reduced heat and water losses and operating costs, improved system efficiency, improved load dispatching using the heat-only boilers as peaking units, and increased effective capacity of the network (see Table 8). The new variable flow operation will make the system much more responsive to changes in demand over the day, which will save energy (through reduced demand) while increasing the comfort of consumers.

5. Part C: Power Transmission and Distribution Reinforcement

95. The recent increase in electricity demand has led to serious overloading of the transmission and distribution system, nearly a quarter of which has already undergone 25 or more years of operation; the result is more frequent instances of voltage drop, power outages, and damage to the equipment. During the feasibility study, load flow studies and detailed assessment of alternative reinforcement programs were carried out to determine the least-cost highest priority transmission and distribution components for inclusion in the Project.

Table 8: District Heating Rehabilitation Benefits

Item	Unit	Without Project	With Project	Change	Percentage Change
Network expansion potential		Unquantified			
System losses	Tcal/yr	675	375	-300	+44
Demand (waste reduction)	Tcal/yr	2,400	2,280	-120	-5
Operating costs	\$million/yr	3.3	2.5	-0.8	-25
Fuel consumption	Tcal/yr	3,000	2,600	-400	-13
Electrical output potential	%				+2
Environmental impact	t coal/yr	1.47	1.37	-0.10	-7

96. The component comprises two new 220/110-kV substations, rehabilitation of various existing 110/35/10-kV and 35/10-kV substations, retrofitting of 110-kV switchgear, and supply of meters and tools. The work is required for maintaining system stability, preventing network overloading, and maintaining flatter voltage profiles (to minimize transmission and distribution losses). The main benefits of transmission and distribution rehabilitation include improved reliability and quality of supply, network expansion potential, and reduced system losses (see Table 9).

Table 9: Transmission and Distribution Reinforcement Benefits

Item	Unit	Without Project	With Project	Change	Percentage Change
System reliability (outages)	GWh/yr			-34	
Network expansion potential	GWh/yr			+130	
System losses, energy	Gwh/yr	2,500	2,403	-97	-4
System losses, capacity	MW	414	4387	-27	-7
Environmental impact	t coal/yr	1.47	1.44	-0.03	-4

97. It is difficult to associate quantifiable benefits directly with the investment costs in transmission and distribution investments, particularly, the benefits of improved reliability. However, the financial and economic internal rates of return were estimated considering the following benefits: (i) outage reduction savings, (ii) system loss reduction, and (iii) incremental sales from releasing system transmission constraints. The financial internal rate of return is estimated at 14 percent and the economic return at 29 percent. These are considered satisfactory, given that the implications of the present serious risk of a prolonged power outage

(lasting a month or more) in the Bishkek and northern region have not been quantified in the analysis.

6. Sensitivity Analysis

98. The sensitivity of the Project's viability under adverse conditions, including a 10 percent reduction in the benefits, a 10 percent increase in capital costs, and a combination of cost overrun and lower benefits, has also been analyzed. The results, summarized in Table 10, indicate that the viability of the Project is insensitive to changes in the key assumptions.

Table 10: Sensitivity of Internal Rates of Return Performance

Component	Case 1		Case 2	Combination of Cases 1 and 2
	Base Case	Benefits Less by 10%	Cost Overrun of 10%	
Economic Internal Rate of Return				
TES1 Rehabilitation	24.1	21.5	21.8	19.4
District Heating Rehabilitation	25.6	23.0	23.2	20.7
Transmission and Distribution Reinforcement	28.5	24.6	26.2	22.6
Total Project	26.5	23.3	24.1	21.2
Financial Internal Rate of Return				
TES1 Rehabilitation	23.3	20.8	21.0	18.7
District Heating Rehabilitation	17.2	14.2	15.3	12.5
Transmission and Distribution Reinforcement	13.8	10.5	12.5	9.4
Total Project	17.2	14.2	15.5	12.6

7. Project Risks

99. The potential risks that may cause problems in Project implementation include (i) front-end delays; (ii) inadequate project management capabilities of KNEHC; and (iii) weak financial condition of KNEHC, which may lead to ineffective operations and affect the financial viability of the Project. Measures have been incorporated into the Project design to reduce these risks. The PIU is being formed and staffed early to enable early implementation. The Project is also being given high priority by the Government in its development program. The Project includes technical support and training activities that will help KNEHC staff strengthen their project management and operating skills. Technical support is being provided to enable the utility to improve its financial management including in particular its billing and collection practices. Also, its tariff-setting mechanism will be rationalized to enable full cost recovery and capability to help finance its continuing long-term development program. This will assure the financial viability of the Project.

B. Environment

100. The emission of air pollutants from the combustion of fossil fuels at TES1 is not monitored at present. Under the Project, monitoring devices will be installed to enable the

operating staff to apply counteractive procedures whenever negative changes in emissions occur.

101. In the cogeneration plant a significant amount of water is consumed because of substantial losses in the district heating network. It is anticipated that, with the rehabilitation of the district heating network, both water and heat losses will be reduced. Rehabilitation of the power system network will reduce technical losses and result in less fuel consumed. This will have the effect of reducing the emissions per unit of useful electrical energy consumed. It is estimated that emissions will be reduced by 8-20 percent depending on the type of pollutant.

C. Social Dimensions

102. The Project will improve the reliability and efficiency of the supply of electricity and heat and in general will benefit the entire consumer population regardless of gender or age. The beneficiaries of the Project will include the existing and future industrial, commercial, and residential electricity consumers in the Kyrgyz Republic and the existing and future consumers of district heating in Bishkek. The Bishkek residents will benefit from decreased emission of air pollutants.

103. The construction work under the Project will generate employment for workers in and around Bishkek during the implementation period. The technical support and training activities under the Project will result in upgrading of skills of KNEHC staff and the general improvement of the management of the utility. As discussed earlier, the Government will ensure that low-income groups will be assisted through a temporary lifeline subsidy program to help them cope with power and heat tariff increases that could have an inordinate impact on their daily cost of living.

VI. ASSURANCES

A. Specific Assurances

104. The Government and KNEHC have given the following assurances, in addition to standard assurances, which have been incorporated in the legal documents:

- (i) KNEHC will take all necessary actions, including tariff adjustments, to ensure that revenues will (a) cover cash operating expenses in 1996, (b) cover all operating expenses including depreciation in 1997, and (c) enable annual self-financing ratios not lower than 30 percent from 1998 onwards.
- (ii) KNEHC will take steps to reduce total accounts receivable to the equivalent of 60 days of billings by 31 December 1997.
- (iii) KNEHC will ensure that its fixed assets will be revalued by 31 December 1996.
- (iv) The Government will take steps to establish a social safety net program for supplying subsidized energy to low-income households including an implementation schedule. Steps will also be taken by 1 July 1997 for the abolition of special discount rates for certain categories of KNEHC customers.

- (v) The Government will take steps to implement the conclusions of the revaluation and tariff study to be undertaken under the Bank-financed technical assistance by 1 July 1997, including the elimination of the cross subsidies benefitting households at the expense of other users, and the introduction of tariffs indexed to the rate of inflation and cost of fuels, on the basis of a formula reflecting KNEHC's true costs.
- (vi) KNEHC will ensure that the Project conforms at all times with internationally acceptable environmental and safety standards, including among others, that (a) no PCB, asbestos, or toxic compounds will be used for the Project facilities; (b) no materials contaminated with PCB, asbestos, or toxic compounds will be reused or recycled for the Project; all materials identified for reuse will be properly cleaned; (c) all materials contaminated with PCB, asbestos, or toxic compounds will be properly identified, labeled, packed, and disposed of in a secured landfill, the site, design, and maintenance of which will be included in the Project design; and (d) all personnel involved in the decommissioning of materials contaminated with asbestos will be briefed about the danger and proper handling of asbestos-contaminated materials and provided with appropriate safety clothing and equipment.

B. Condition of Loan Effectiveness

105. The enactment of the legislation, acceptable to the Bank, for the energy and electricity sectors will be a condition for effectiveness of the loan.

VII. RECOMMENDATION

106. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Bank and recommend that the Board approve the loan in various currencies equivalent to Special Drawing Rights 20,483,000 to the Kyrgyz Republic for the Power and District Heating Rehabilitation Project, with a service charge at the rate of 1 percent per annum and with an amortization period of 40 years, including a grace period of 10 years, and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan and Project Agreements presented to the Board.

MITSUO SATO
President

10 May 1996

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SUPPLEMENTARY APPENDIXES

(available on request)

A	External Assistance to the Energy Sector
B	Terms of Reference for Petroleum Exploration Promotion

**ENERGY SECTOR DATA
KYRGYZ REPUBLIC**

Table 1. Commercial Energy Balance, 1991

	Coal	Crude Oil	Petroleum Products	Natural Gas	Electricity	District Heating	Total
In Specific Quantities	('000 mt)	('000 mt)	('000 mt)	(mn m ³)	(GWh)	(Tcal)	
Primary Energy Source							
Production	3,483	143		70	10,058 ^a		
Imports	2,657		2,589	2,136	1,054		
Exports	(1,740)	(143)			(5,346)		
Total Primary Energy Source	4,400	0	2,589	2,206	5,766	0	
Conversion and Losses							
Conversion to Electricity and Heat	(1,000)		(300)	(1,040)	3,914	5,806	
Losses					(1,551)	(383) ^b	
Total Supplied to Users	3,400	0	2,289	1,166	8,129	5,423	
Consumption							
Households	2,542		118	139	1,455	3,037	
Industry	700		1,042	731	3,509	1,247	
Agriculture			535		1,986	108	
Transport			329				
Others	158		265	296	1,179	1,030	
Total Consumption	3,400	0	2,289	1,166	8,129	5,423	
In Tons of Oil Equivalent ('000 toe)							
Primary Energy Source							
Production	1,393	143	0	57	865 ^a	0	2,458
Imports	1,063	0	2,589	1,730	91	0	5,473
Exports	(696)	(143)	0	0	(460)	0	(1,299)
Total Primary Energy Source	1,760	0	2,589	1,787	496	0	6,632
Conversion and Losses							
Conversion to Electricity and Heat	(400)	0	(300)	(842)	337	58	(1,148)
Losses	0	0	0	0	(133)	(4) ^b	(137)
Total Supplied to Users	1,360	0	2,289	944	699	54	5,347
Consumption							
Households	1,017	0	118	113	125	30	1,403
Industry	280	0	1,042	592	302	12	2,229
Agriculture	0	0	535	0	171	1	706
Transport	0	0	329	0	0	0	329
Others	63	0	265	240	101	10	680
Total Consumption	1,360	0	2,289	944	699	54	5,347

^a Hydroelectric power generation.

^b Losses as measured by bulk meters only.

Sources: (i) The World Bank

(ii) Technical Assistance for the Commonwealth of Independent States (European Union program)

Table 2. Commercial Energy Balance, 1994

	Coal	Crude Oil	Petroleum Products	Natural Gas	Electricity	District Heating	Total
In Specific Quantities	('000 mt)	('000 mt)	('000 mt)	(mn m ³)	(GWh)	(TCal)	
Primary Energy Source							
Production	670	90		39	10,710 ^a		
Imports	1,358		700	1,000	1,747		
Exports	(162)	(90)			(4,252)		
Total Primary Energy Source	1,866	0	700	1,039	8,205	0	
Conversion and Losses							
Conversion to Electricity and Heat	(800)		(150)	(224)	1,140	3,335	
Losses	(14)				(1,520)	(620) ^b	
Total Supplied to Users	1,052	0	550	815	7,825	2,715	
Consumption							
Households	800		20	312	3,154	1,502	
Industry	152		129	468	2,001	498	
Agriculture			152		1,526	96	
Transport			149				
Others	100		100	35	1,144	619	
Total Consumption	1,052	0	550	815	7,825	2,715	
In Tons of Oil Equivalent ('000 toe)							
Primary Energy Source							
Production	268	90	0	32	921 ^a	0	1,311
Imports	543	0	700	810	150	0	2,203
Exports	(65)	(90)	0	0	(366)	0	(520)
Total Primary Energy Source	746	0	700	842	706	0	2,994
Conversion and Losses							
Conversion to Electricity and Heat	(320)	0	(150)	(181)	98	33	(520)
Losses	(6)	0	0	0	(131)	(6) ^b	(143)
Total Supplied to Users	421	0	550	660	673	27	2,331
Consumption							
Households	320	0	20	253	271	15	879
Industry	61	0	129	379	172	5	746
Agriculture	0	0	152	0	131	1	284
Transport	0	0	149	0	0	0	149
Others	40	0	100	28	98	6	273
Total Consumption	421	0	550	660	673	27	2,331

^a Hydroelectric power generation^b Losses as measured by bulk meters only.

Sources: (i) The World Bank

(ii) Technical Assistance for the Commonwealth of Independent States (European Union program)

Table 3. Electricity Balance
1991 – 1994
(in GWh)

	1991	1992	1993	1994	Total 1991 – 1994	Per Cent of Total
GENERATION						
Hydro power						
Toktogul Cascade	9,816	8,944	8,630	11,305	38,695	78.2
Atbashi	123	139	150	155	567	1.1
Kemin	40	39	46	40	165	0.3
Alamedin	79	68	71	78	296	0.6
Subtotal	10,058	9,190	8,897	11,578	39,723	80.3
Thermal						
Bishkek	3,685	2,397	1,896	1,052	9,030	18.3
Osh	229	205	194	88	716	1.4
Subtotal	3,914	2,602	2,090	1,140	9,746	19.7
Gross Generation	13,972	11,792	10,987	12,718	49,469	100.0
Imports and Station Use						
Imports		88	182		270	
Station Use	(487)	(404)	(355)	(286)	(1,532)	
Subtotal	(487)	(316)	(173)	(286)	(1,262)	
Net Available	13,485	11,476	10,814	12,432	48,207	
SALES						
Domestic						
Residential						
Urban	573	820	1,088	1,521	4,002	9.5
Rural	882	1,131	1,367	1,638	5,018	11.9
Agriculture	1,986	1,872	1,846	1,526	7,230	17.2
Industry	3,509	2,974	2,489	2,060	11,032	26.2
Government institutions	1,180	1,315	1,195	1,085	4,775	11.4
Subtotal	8,130	8,112	7,985	7,830	32,057	76.2
Exports						
Kazakhstan	4,293	2,176	1,023	2,503	9,995	23.8
PRC				2	2	0.0
Subtotal	4,293	2,176	1,023	2,505	9,997	23.8
Total Sales	12,423	10,288	9,008	10,335	42,054	100.0

Source: European Bank for Reconstruction and Development

ACTION PLAN FOR ENERGY SECTOR RESTRUCTURING

Subsector/Area	Current Status	Actions	Indicative Timing
1 ENERGY SECTOR MANAGEMENT			
Sector policy formulation	Need to strengthen sector policy formulation capacity	Entrust single agency with formulation of energy policies	Mid – 1996
Regulatory framework	Weak regulatory framework for the energy sector	Assess options for level of regulatory control	End – 1996
		Establish regulatory agency	End – 1997
Energy trade arrangements	Arrangements need to be renegotiated	Convene a regional conference on energy trade	Mid – 1997
Financial management and accounting practices	Not in conformity with international standards	Introduce internationally accepted practices in financial management in the energy sector agencies	End – 1996
Data base	Sector data are scarce and incomplete	Complete a detailed data base	End – 1997
2 POWER AND DISTRICT HEATING			
Regional arrangements for water and power	Power generation is constrained by water needs of other countries	Regional discussion on valuing opportunity cost of regulated water for irrigation and hydropower, and optimization of long-term development of the regional power system	End – 1997
Tariffs	Tariffs are artificially low	Increase tariffs to cover cash operating costs	Mid – 1996
		Increase tariffs to cover operating costs including depreciation	End – 1996
		Increase tariffs to enable KNEHC to help finance part of its capital expenditures	End – 1997
Organization	Need to improve sectoral organization	Consider options for strengthening organizational structure for the power and district heating subsectors	End – 1996
Institutional framework	Corporate and regulatory framework is unclear	Prepare draft Electricity law	End – 1995
		Assess options for regulatory controls	Mid – 1996
		Prepare sector regulations	End – 1997

Subsector/Area	Current Status	Actions	Indicative Timing
General and financial management of KNEHC	Needs improvement	Prepare a program for corporate and financial management restructuring of KNEHC	End – 1996
		Initiate program implementation	Mid – 1997
Distribution and transmission network	Overloaded	Give priority to investment in rehabilitation of the transmission and distribution network	1996 – 1999
District heating systems	In poor condition and inefficient	Give priority to investment in rehabilitation of cogeneration and district heating systems in Bishkek and Osh	1996 – 1999
Kambarata 2 hydropower project	Project is 30 per cent complete and has run out of funds	A long – term purchase contract should be concluded before proceeding with project completion	End – 1997
Export market for power	Need to expand market	Assess feasibility of export expansion	End – 1996
3 NATURAL GAS			
Supply	Need to secure long – term supply	Assess potential for gas use in Kyrgyz Republic and review options for pricing and contracts	End – 1997
Tariffs	Tariffs for domestic use are artificially low	Increase tariffs to cover cash operating costs	End – 1996
		Increase tariffs to cover operating costs including depreciation	End – 1997
		Increase tariffs to meet financial targets of Kyrgyzgas	End – 1998
Consumer meters	Lack of meters	Review meter technology options	End – 1996
		Prepare installation plan and financing	End – 1997
		Complete installation	End – 1999
General and financial management of Kyrgyzgas	Need for improvement	Prepare a program for corporate and financial restructuring of Kyrgyzgas	Mid – 1996
		Initiate program implementation	Mid – 1997
LPG marketing	Need for privatization	Prepare privatization program	Mid – 1996
		Implement program	Mid – 1997
Transmission and distribution	Need to improve safety and efficiency	Assess condition of gas network and system operation and maintenance practices	Mid – 1996

Subsector/Area	Current Status	Actions	Indicative Timing
4 PETROLEUM PRODUCTS			
Regulatory framework	Need to formulate	Prepare regulations on petroleum products	Mid-1996
		Enact regulations	Mid-1997
Trading	Need to privatize	Prepare privatization program	End-1996
		Implement program	Mid-1997
Supply	Need for improvement	Study options for improving supplies through Chimkent refinery	Mid-1996
5 PETROLEUM EXPLORATION			
Government involvement	Need to privatize	Enact petroleum law and approve model contract	End-1996
Exploration strategy	None	Assess existing data and review exploration and recovery prospects	End-1996
		Prepare exploration promotion strategy	Mid-1997
		Award selected exploration areas	Mid-1998
Institutional framework	Need to restructure Kyrgyzneft and Goskomgeologia	Set up Kyrgyzneft as the state oil company and spin off the drilling unit	End-1996
		Prepare a program to restructure Goskomgeologia, particularly its geological function	End-1996
		Implement Goskomgeologia restructuring	End-1997
6 COAL			
Institutional framework	Need to restructure the coal sector	Close uneconomic mines (about 7)	End-1996
		Prepare plan for closing or restructuring remaining mines	Mid-1997
		Close mines with depleted economic reserves (about 3-5)	Mid-1997
Unemployment	Need to address unemployment that will result from mine closures	Prepare strategy to mitigate impact of expected employment reduction (about 5,000-6,000)	Mid-1996
		Set or make available social safety net	Mid-1996
Safety and environment	Inadequate standards	Prepare regulations for the coal sector	Mid-1996
		Enact regulations	Mid-1997
Trading	Need for privatization	Prepare privatization program	End-1996
		Implement program	Mid-1997

PROJECT FRAMEWORK: POWER AND DISTRICT HEATING REHABILITATION PROJECT, KGZ

Design Summary	Targets	Project Monitoring Mechanism	Risks
1. Sector/Area Goals <ul style="list-style-type: none"> Support national economic growth Efficient utilization of existing resources 	<ul style="list-style-type: none"> Elimination of unserved energy demand Elimination of need for additional power generation facilities 	<ul style="list-style-type: none"> Annual economic statistics System performance reports 	<ul style="list-style-type: none"> Political instability Economic stagnation
2. Objectives <ul style="list-style-type: none"> Efficient and reliable supply of electricity and heat in Bishkek Reduction of energy losses Reduction of adverse environmental impact Extension of economic life of existing assets 	<ul style="list-style-type: none"> Reduced power outages Elimination of district heating outages during winter Savings in fuel imports Reduced emissions per unit of power/heat supplied Postponement of need for replacement equipment 	<ul style="list-style-type: none"> Utility annual reports and system performance reports Project Completion Report 	<ul style="list-style-type: none"> Uncontrolled growth in demand for power and heat due to continuing low tariffs
3. Project Components/Outputs <ul style="list-style-type: none"> Rehabilitation of Bishkek Thermal Energy Station (TES1) Rehabilitation of district heating system Reinforcement of transmission and distribution facilities Technical support and training 	<ul style="list-style-type: none"> 7 boilers refurbished Turbine No. 11 installed Various equipment installed 13 km of dilapidated pipes replaced Variable flow capability introduced Substations upgraded New Naryn and Ala-archa substations Reinforced Chuiskala substation Retrofitted switchgear and substations Meters provided Billing and collection improvement study Power/heat sector reform study Petroleum exploration promotion study Training Project management assistance 	<ul style="list-style-type: none"> Project progress reports and review missions Project progress reports and review missions Project progress reports and review missions Project progress reports and review missions 	<ul style="list-style-type: none"> Weak project management Delayed availability of local funds Weak project management Delayed availability of local funds Weak project management Delayed availability of local funds Weak Project Implementation Unit Delayed availability of local funds
4. Activities <ul style="list-style-type: none"> Rehabilitate TES1 <ul style="list-style-type: none"> Rehabilitate boilers Rehabilitate turbines Upgrade instrumentation Rehabilitate district heating <ul style="list-style-type: none"> Rehabilitate network Modernize system Modernize substations Reinforce transmission and distribution <ul style="list-style-type: none"> Reinforce 220/110 kV substations Retrofit 110 kV switchgear Rehabilitate other substations Provide meters and tools Provide technical support and training 	5. Inputs <ul style="list-style-type: none"> \$17.9 mn (base cost) \$25.6 mn (base cost) \$25.3 mn (base cost) \$4.1 mn (base cost) 110 staff-months of consulting services 	<ul style="list-style-type: none"> Project progress reports and review missions Project progress reports and review missions Project progress reports and review missions Project progress reports and review missions 	<ul style="list-style-type: none"> Delay in procurement Weak project management Delay in procurement Weak project management Delay in procurement Weak project management Delay in recruitment of consultants

PROJECT DESCRIPTION

A. Description of Project Components

1. Part A. Bishkek Thermal Energy Station (TES1) Rehabilitation

a. Rehabilitation of Boilers

1. Seven boilers (Boilers Nos. 14-20) have been in operation for less than 100,000 hours and have been selected for refurbishment. The priority activities include the following:

- (i) furnace wall removal and replacement in the burner zone (approximately 15 percent of wall tubing per boiler) for the seven boilers; and
- (ii) boiler refractory/brick lining insulation, lagging, casing repair, or refurbishment, and furnace roof superheater tube penetration seal refurbishment for the seven boilers.

b. Rehabilitation of Turbine-Generators and Auxiliaries

2. The priority activities are as follows:

- (i) Turbine No. 11, rated at 90 MW under local steam conditions, has been delivered but not yet installed; under the Project, the generator and auxiliaries will be supplied, and the turbine-generator installed and commissioned;
- (ii) replacement of condenser tubes for Turbine-generator No. 3;
- (iii) replacement of turbine shaft sealing components on the High Pressure end for Turbine-generator No. 7;
- (iv) replacement of shaft coupling High Pressure to Intermediate Pressure and bearing No. 2 for Turbine-generator No. 8;
- (v) provision of nondestructive examination equipment for a metal testing laboratory; and
- (vi) provision of portable vibration monitoring equipment.

c. Instrumentation and Control Upgrade and Environmental Monitoring

3. The priority activities are as follows:

- (i) replacement of the control room indicating devices with computer workstations;
- (ii) purchase and installation of computers connected to the plant information system;
- (iii) purchase and installation of flow, pressure, temperature, and level transmitters for various plant systems; and
- (iv) purchase and installation of emission monitoring devices.

d. Other Plant Equipment

4. These will include the following:

- (i) purchase and installation of a rotary car coal dumper;

- (ii) purchase and installation of new air compressors;
- (iii) replacement of outdated plant instrumentation and control devices; and
- (iv) installation of monitoring devices for emissions of SO_x and NO_x.

2. Part B. District Heating Rehabilitation

a. Rehabilitation of Network

5. The most dilapidated network sections (about 13 kilometers [km]) will be replaced with pre-insulated pipes to stop serious leakage and reduce heat loss. Damaged and poor insulation of the aerial sections of the network (about 7 km) will be replaced with mineral wool covered with reinforced concrete.

b. System Modernization

6. Variable-flow capability will be introduced into the system through the installation of frequency converters on selected pumps and of the automatic control system necessary to get the full benefit of the variable-flow operations.

c. Substations Modernization

7. Substations will be modernized to adapt to variable-flow operation. Energy meters will be installed as a first step towards the introduction of consumption-based tariffs.

3. Part C. Power Transmission and Distribution Reinforcement

a. 220/110-kV Substation Reinforcement

8. This will include the following:

- (i) A new substation will be built in Naryn to improve the reliability of electricity supply in the areas around Issyk Kul Lake and the city of Naryn. The equipment and work required will include (i) two new 125 megavoltamperes (MVA) transformers, (ii) 220-kilovolt (kV) single bus-bars, (iii) two 220-kV autotransformer feeders and two 110-kV autotransformers; (iv) six 110-kV outgoing feeders, (v) 110-kV double bus-bars, (vi) two 35-kV capacitor banks, (vii) electrical communication and protection equipment, and (viii) substation lighting and reinforcement of the earthing system.
- (ii) A new Ala-Archa Substation will be constructed to provide a third independent bulk power supply source to the city of Bishkek to improve its supply reliability. Two 125-MVA transformers, three 220-kV and eleven 110-kV circuit breakers, and a 100-MVAR capacitor rated at 110-kV will be installed. Associated 20 km of 220-kV and 5.3 km of 110-kV transmission lines will be built, and a system protection capability will be included as well.
- (iii) The Chuiskaia Substation will be reinforced with a relocated 125-MVA transformer to increase its capacity to serve mainly industrial loads. Three additional 220-kV

and one additional 100-kV circuit breakers will be purchased and installed. The substation system protection will also be upgraded together with construction of an additional 1 km of 220-kV double circuit transmission line.

2. Retrofitting of 110-kV Switchgear

9. This will include elimination of 110-kV ground switches/disconnecters by addition of 110-kV circuit breakers at the following 12 substations: two units each at Aini; Alamedin; Energeticheskaya; Karagachevaia; Novo-Vostochnaia; Novo-Yuzhnaia; Novo-Zapadnaia; Pikovaia-Kotelnaia; Promyshlennaia; Yuzhnaia; and one unit each at Kostromskaia and Molodogvardeiskaia.

c. Rehabilitation of 110/35/10-kV and 35/10-kV Substations

10. This will include the following substations:

- (i) Orto Alysh Substation — purchase and installation of one 25-MVA, 110/35/10-kV autotransformer; one 110-kV, two 35-kV, and eight 10-kV circuit breakers; and associated 1 km of double circuit transmission line;
- (ii) Selectra Substation — purchase and installation of one 6.3-MVA, 35/10-kV transformer; and four 10-kV circuit breakers;
- (iii) Selectsionnaia Substation — purchase and installation of one 25-MVA, 110/10-kV transformer; and one 110-kV and ten 10-kV circuit breakers; and
- (iv) Novo-Troickaia Substation — purchase and installation of two 40-MVA, 110/35/10-kV transformers; and five 110-kV circuit breakers.

d. Meters and Tools

11. This will include purchasing of about 100,000 units of kilowatt-hour (kWh) meters to be installed at consumers' premises who are presently without meters, cable splicing and repair tools, and miscellaneous spare parts.

4. Part D. Technical Support and Training

12. Under the Project, consultant services will be provided to assist KNEHC in Project preparation activities including Project Implementation Unit (PIU) establishment, preparation of bidding documents, bid evaluation, negotiation of contracts, and supervision of erection work. Other technical support will include (i) petroleum exploration promotion; (ii) organizational strengthening; (iii) computerized billing and collection improvement; and (iv) various training needs.

B. Benefit Analysis of Project Components

13. The benefits accruing from the different Project components and subcomponents are summarized in Table 1. These comprised the technical justification for the choice of components to make up the Project.

Table 1: Benefit Analysis of Project Components

Component/Subcomponent	Base Cost (\$ million)	Percent of		Benefits
		Comp- onent	Project	
Part A. Bishkek TES1				
Rehabilitation of Boilers				
Refractory refurbishment, roof tube penetration seal rehabilitation; furnace wall tubing replacement	3.84	21.4	5.6	Improved boiler capacity and efficiency; life extension
Turbine Generator Rehabilitation				
Installation of Turbogenerator No. 11	7.50	41.9	10.9	Increased electrical (90 MW) and district heating capacity and efficiency; replacement of output of units Nos. 1 and 2
Nondestructive examination equipment; vibration monitoring equipment	0.80	4.4	1.2	Improved maintenance or replacement scheduling
Replacement of various condenser tubes, turbine shaft sealing system, rotor coupling	0.17	0.9	0.2	Necessary repairs
Others				
Instrument and control upgrading	3.85	21.5	5.6	Improved plant efficiency and control
Environmental monitoring equipment	0.21	1.1	0.3	Improved monitoring of plant emissions; improved monitoring and control of combustion
Rotary car dumper coal unloading facility	1.27	7.1	1.8	Improved plant availability and reliability during peak winter season
Air compressors	0.29	1.6	0.4	Enhanced plant operations and pneumatic transport of boiler fly ash
Subtotal, Part A	17.91	100.0	25.9	
Part B. District Heating				
Network Rehabilitation	13.59	53.1	19.7	Reduced system losses
Substation Rehabilitation; SCADA System; Pump Modernization	11.99	46.9	17.4	Allows load dispatch; increased network capacity; reduced power consumption; reduced flow temperatures; reduced coincident demand
Subtotal, Part B	25.59	100.0	37.1	
Part C. Transmission and Distribution				
Ala–Archa Substation (New); Naryn Substation (New)	14.10	55.2	20.4	Reduced risk of serious blackout for service areas; reduced system losses (18.4 GWh or 10–15%); accommodates future load growth
Chuiskaia Substation	1.90	7.4	2.8	Reduced risk of equipment overload and outages east of Bishkek; higher capacity operation of TES1; reduced system losses (22.1 Gwh)
Circuit Breakers, 110 kV	3.08	12.1	4.5	Improved reliability of Bishkek system with high–speed relays
Orto Alysh, Selectra, Selectionaia, and Novo–Troickaia Substations	4.45	17.4	6.4	Avoids transformer overloads and extended power disruptions in case of failure; allows redeployment of replaced transformers
Meters and Other Equipment	2.00	7.8	2.9	Improved end user energy conservation and utility cost recovery
Subtotal, Part C	25.53	100.0	37.0	
Total Parts A, B and C	69.03		100.0	

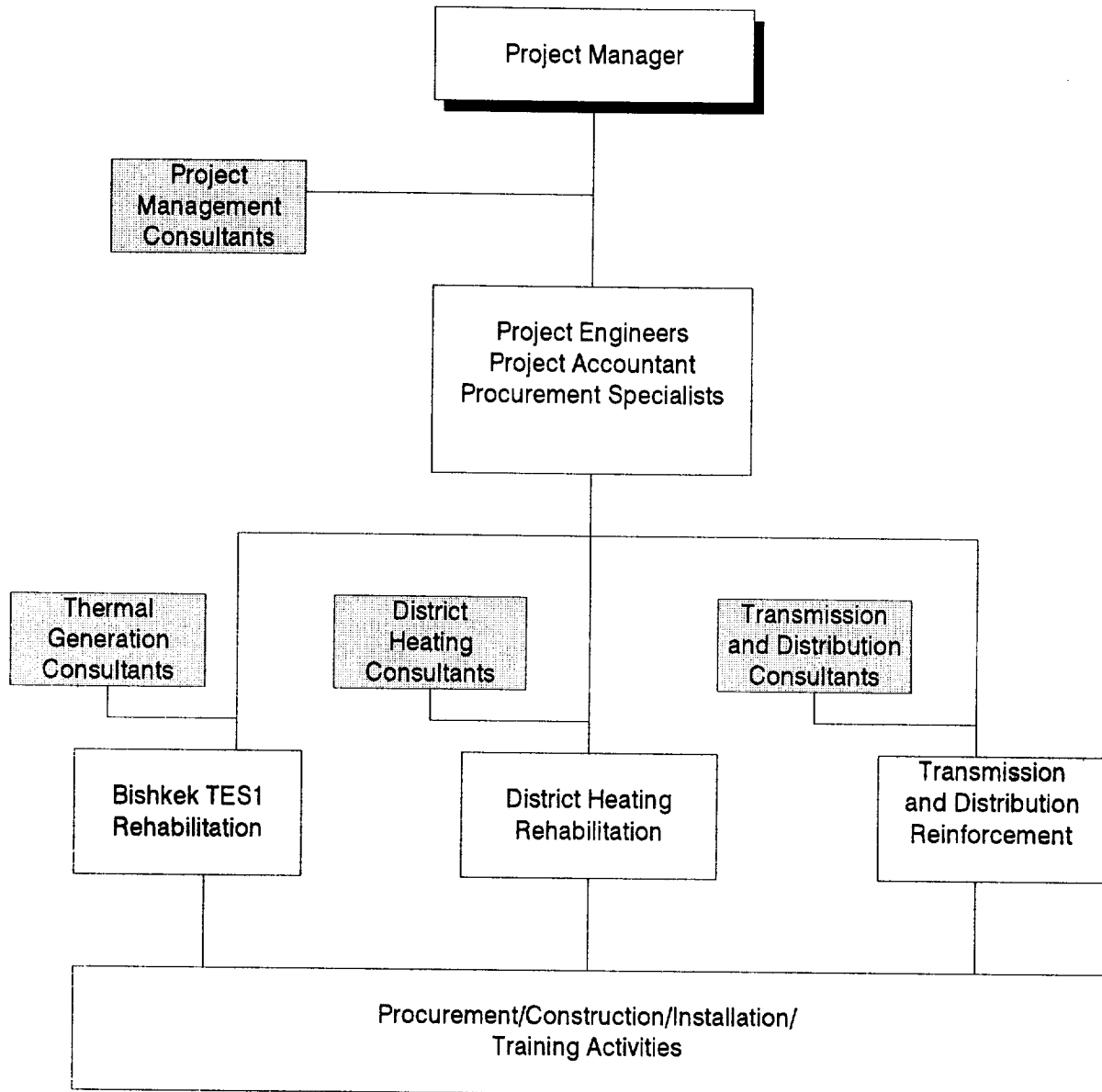
PROJECT COST ESTIMATES AND FINANCING PLAN
Power and District Heating Rehabilitation Project
(\$ million)

	Project Cost			Financing Plan						
	Foreign Exchange	Local Cost	Total	ADB FE	WB FE/LC	DANIDA FE	NDF FE	Swiss FE	KNEHC LC	Govt FE/LC
BASE COST										
A. Bishkek TES1										
Equipment	13.9	1.9	15.8		13.2				0.3	2.3
Civil Works	0.0	1.1	1.1		0.0				1.1	
Design and Supervision	0.7	0.3	1.0		0.7				0.3	
Total A	14.6	3.3	17.9		13.9				1.7	2.3
B. District Heating										
Equipment	19.9	0.0	19.7	10.1		7.4	2.4		0.0	
Civil Works	0.0	5.0	5.0	0.0					5.0	
Design and Supervision	0.2	0.5	0.9	0.2					0.5	
Total B	20.1	5.5	25.6	10.3		7.4	2.4		5.5	
C. Transmission and Distribution										
Equipment	22.1	0.6	22.6	14.9			3.7	3.5	0.6	
Civil Works	0.0	2.5	2.5	0.0					2.5	
Design and Supervision	0.7	0.3	1.0	0.3				0.4	0.3	
Total C	22.8	2.8	25.6	15.2			3.7	3.9	2.8	
D. Technical Support and Training										
Consulting Services	2.8	0.4	3.2		2.8				0.4	
Petroleum Exploration Promotion Study	0.3	0.0	0.3		0.3				0.0	
Training	0.6	0.0	0.6		0.6				0.0	
Total D	3.7	0.4	4.1		3.7				0.4	
Total Base Cost	61.2	12.0	73.2	25.5	17.6	7.4	6.1	3.9	10.4	2.3
CONTINGENCIES										
Physical	6.0	1.2	7.2	2.6	1.8	0.7	0.6	0.4	1.2	0.0
Price	3.9	3.1	7.0	1.9	0.6	0.5	0.1	0.2	3.6	
Subtotal	9.9	4.3	14.2	4.5	2.4	1.2	0.7	0.6	4.8	0.0
Total before IDC	71.1	16.3	87.4	30.0	20.0	8.6	6.8	4.5	15.2	2.3
Interest during Construction	1.3	9.7	11.0							11.0
TOTAL PROJECT COST	72.4	26.0	98.4	30.0	20.0	8.6	6.8	4.5	15.2	13.3
Percentage Financing (%)	73.6%	26.4%	100.0%	30.5%	20.3%	8.7%	6.9%	4.6%	15.5%	13.5%

Notes:

1. Base costs are in January 1996 prices. An exchange rate of \$1.00 to Som 11.0 was used.
2. Physical contingencies are estimated at about 10 percent.
3. Price escalation is estimated for foreign currency costs at 15 percent in 1996, 9 percent in 1998, 4.1 percent in 1998 and 2.6 percent in 199 and thereafter; and for local currency costs at 3.3 percent in 1996, 2.3 percent in 1997 and 2.5 percent in 1998 and thereafter.

ORGANIZATION CHART OF THE PROJECT IMPLEMENTATION UNIT
Power and District Heating Rehabilitation Project



[illegible]

PROJECT CONTRACT PACKAGING
Power and District Heating Rehabilitation Project
(\$ million)

Contract Package	Source of Financing	Cost ^{a/} (\$ million)	Procurement Mode
A. TES1 Rehabilitation			
Equipment and Materials			
Boiler Refurbishment	IDA	3.15	ICB
Turbine Refurbishment	IDA	5.06	ICB
Monitoring and Control Instrumentation	IDA	2.16	ICB
Auxiliary Equipment	IDA	1.16	ICB
Consulting Services	IDA	0.58	CFG
B. District Heating Rehabilitation			
Equipment and Materials			
Pipe Network	ADB	9.83	ICB
Substations	DANIDA	6.90	CFG
Control Equipment	NDF	0.78	CFG
Pumps	NDF	2.51	CFG
Consulting Services	ADB	0.49	CFG
C. Transmission and Distribution Reinforcement			
Equipment and Materials			
Substations Ala Archa (new) and Chuiskaia (existing)	ADB	8.76	ICB
Substation Naryn (new)	Swiss	4.06	CFG
Circuit Breakers (12 substations)	NDF	2.70	CFG
Equipment (Orto Alysh, Selectsionnaia, Nova Troickaia and Selectra)	ADB	3.35	ICB
Meters and Other Equipment	ADB	2.36	ICB
Consulting Services	ADB	0.72	CFG
D. Technical Support and Training			
Consulting Services			
Assistance to PIU	IDA	1.00	ICB
Billing and Collection	IDA	1.08	ICB
Organization Study	IDA	0.91	ICB
Petroleum Exploration Promotion	IDA	0.30	ICB
Training	IDA	0.54	ICB
Training	IDA	0.58	CFG

^{a/} Base cost in 1996 prices.

Notes:

- CFG = cofinancier's guidelines
- ICB = international competitive bidding;
- IDA = International Development Association
- DANIDA = Danish International Development Agency
- NDF = Nordic Development Fund

TERMS OF REFERENCE FOR PROJECT IMPLEMENTATION CONSULTING SERVICES

A. Bishkek Thermal energy Station No. 1 (TES1) Rehabilitation

1. Objective and Scope of Work

1. The objective of the implementation consulting services for Part A is to assist the Project Implementation Unit (PIU) of the Kyrgyz National Energy Holding Company (KNEHC) in the day-to-day implementation of the Power and District Heating Rehabilitation Project with particular regard to Part A — Thermal Energy Station Rehabilitation. The consultant will be responsible to KNEHC for the provision of assistance for such matters as bid evaluation, contract negotiations, engineering design review and supervision of installation, and testing and commissioning of the work associated with the various Project components. The consultant will also undertake to transfer technology to concerned personnel of KNEHC and the PIU.

2. Detailed Terms of Reference

2. The consultant will perform the following tasks:

a. Contracting Phase

- (i) Assist in preparing bid documents, including technical specifications, for procurement of goods and services.
- (ii) Assist in the evaluation of tenders and in awarding contracts to the most suitable bidders.
- (iii) Prepare draft contract documents for the various contracts.
- (iv) Participate in contract negotiations as requested by KNEHC.

b. Project Implementation Phase

- (i) Prepare a project implementation manual covering aspects such as project description and organization, payment procedures for contractor's invoices, project time schedule, and quality assurance program.
- (ii) Review designs proposed by contractors.
- (iii) Coordinate safety measures to separate components under rehabilitation and components in operation, including the safe handling and disposal of asbestos-containing materials, which at present are widely used.
- (iv) Initiate actions as required to fulfill KNEHC's obligations such as provisions for water, power, and other services as defined in the contracts.
- (v) Arrange site meetings with the contractors' management team to coordinate work and record progress.
- (vi) Provide necessary services for the supervision of the construction works to ensure completion within the time schedule and to ensure that the works are performed in accordance with the scope and requirements defined in the contracts signed for them.
- (vii) Issue certificates of interim payment, completion, and final payment in accordance with the procedures defined in the project manual and in accordance with conditions in the contracts.
- (viii) Monitor project progress and report to KNEHC and the cofinancing agencies in

- accordance with the procedures required by the cofinanciers.
- (ix) Assist in settling disputes or differences of opinion that may arise between KNEHC and the contractors.
- (x) Provide support during clearance of construction claims, if any, and monitor the performance of substations during the warranty periods.
- (xi) Perform all duties as necessary and incidental to the satisfactory execution of the Project.
- (xii) Prepare a Project completion report.

c. Manuals and Documentation Update

- (i) Coordinate the preparation of operation and maintenance (O&M) manuals for installed equipment including operating instructions during abnormal operation.
- (ii) Coordinate the updating of existing plant and equipment documentation and make corrections to drawings and other documents to comply with the modifications and design changes resulting from the rehabilitation program.

3. Implementation

3. The consulting services are expected to be carried out over a period of four years with an estimated input of about 20 person-months by internationally recruited consultants. Experts in rehabilitation or refurbishment and O&M of thermal cogeneration plants are required. Experience in Russian cogeneration technology will be an advantage.

4. Reporting

4. The following reports will be required during the rendering of the consulting services: (i) monthly progress reports, (ii) plant and equipment O&M manuals, and (iii) final report upon Project completion.

B. Bishkek District Heating Rehabilitation

1. Objective and Scope of Work

5. The objective of the implementation consulting services for Part B is to assist the PIU in the day-to-day implementation of the Power and District Heating Rehabilitation Project with particular regard to Part B — District Heating Rehabilitation. The consultant will be responsible to KNEHC for the provision of assistance for such matters as bid evaluation, contract negotiations, engineering design review and supervision of installation, and testing and commissioning of the work associated with the various Project components. The consultant will also undertake to transfer technology to concerned personnel of KNEHC, the Bishkek District Heating Enterprise, and the PIU.

2. Detailed Terms of Reference

6. The consultant will perform the following tasks:

a. Contracting Phase

- (i) Assist in preparing bid documents, including technical specifications, for

- procurement of goods and services.
- (ii) Assist in the evaluation of tenders and in awarding contracts to the most suitable bidders.
- (iii) Prepare draft contract documents for the various contracts.
- (iv) Participate in contract negotiations as requested by KNEHC.

b. Project Implementation Phase

- (i) Prepare a project implementation manual covering aspects such as project description and organization, payment procedures for contractor's invoices, project time schedule, and quality assurance program.
- (ii) Review designs proposed by contractors.
- (iii) Coordinate safety measures to separate components under rehabilitation and components in operation, including the safe handling and disposal of decommissioned materials that contain asbestos.
- (iv) Initiate actions as required to fulfill KNEHC's obligations such as provisions for water, power, and other services as defined in the contracts.
- (v) Arrange site meetings with the contractors' management team to coordinate work and record progress.
- (vi) Provide necessary services for the supervision of the construction works to ensure completion within the time schedule and to ensure that the works are performed in accordance with the scope and requirements defined in the contracts signed for the works.
- (vii) Issue certificates of interim payment, completion, and final payment in accordance with the procedures defined in the project manual and in accordance with conditions in the contracts.
- (viii) Monitor project progress and report to KNEHC and the cofinancing agencies in accordance with the procedures required by the cofinanciers.
- (ix) Assist in settling disputes or differences of opinion that may arise between KNEHC and the contractors.
- (x) Provide support during clearance of construction claims, if any, and monitor the performance of substations during the warranty periods.
- (xi) Perform all duties as necessary and incidental to the satisfactory execution of the Project.
- (xii) Prepare a Project completion report.

c. Manuals and Documentation Update

- (i) Coordinate the preparation of substation and pumping station O&M manuals including operating instructions during abnormal operation.
- (ii) Coordinate the updating of existing substation and pumping station documentation and make corrections to drawings and other documents to comply with the modifications and design changes resulting from the rehabilitation program.

3. Implementation

7. The consulting services are expected to be carried out over a period of four years with an estimated input of about 20 person-months by internationally recruited consultants. Experts in rehabilitation or refurbishment and O&M of district heating and thermal cogeneration

plants are required. Experience in operation, design, and planning of district heating using Russian cogeneration technology will be an advantage.

4. Reporting

8. The following reports will be required during the rendering of the consulting services: (i) monthly progress reports, (ii) substation and pumping station O&M manuals, and (iii) final report upon Project completion.

C. Power Transmission and Distribution Reinforcement

1. Objective and Scope of Work

9. The objective of the implementation consulting services for Part C is to assist the PIU in the day-to-day implementation of the Power and District Heating Rehabilitation Project with particular regard to Part C — Power Transmission and Distribution Reinforcement. The consultant will be responsible to KNEHC for the provision of assistance for such matters as bid evaluation, contract negotiations, engineering design review and supervision of installation, and testing and commissioning of the work associated with the various Project components. The consultant will also undertake to transfer technology to concerned personnel of KNEHC and the PIU, including the substitution and safe disposal of environmentally harmful materials such as chlorobiphenyl composites, if any, in transformer coolants with environmentally acceptable materials.

2. Detailed Terms of Reference

10. The consultant will perform the following tasks:

a. Contracting Phase

- (i) Assist in preparing bid documents, including technical specifications, for procurement of goods and services.
- (ii) Assist in the evaluation of tenders and in awarding contracts to the most suitable bidders.
- (iii) Prepare draft contract documents for the various contracts.
- (iv) Participate in contract negotiations as requested by KNEHC.

b. Project Implementation Phase

- (i) Prepare a project implementation manual covering aspects such as project description and organization, payment procedures for contractor's invoices, project time schedule, and quality assurance program.
- (ii) Review designs proposed by contractors.
- (iii) Coordinate safety measures to separate components under rehabilitation and components in operation, including the safe handling and disposal of environmentally harmful materials that at present are used.
- (iv) Initiate actions as required to fulfill KNEHC's obligations such as provisions for water, power, and other services as defined in the contracts.
- (v) Arrange site meetings with the contractors' management team to coordinate work and record progress.

- (vi) Provide necessary services for the supervision of the construction works to ensure completion within the time schedule and to ensure that the works are performed in accordance with the scope and requirements defined in the contracts signed for the works.
- (vii) Issue certificates of interim payment, completion, and final payment in accordance with the procedures defined in the project manual and in accordance with conditions in the contracts.
- (viii) Monitor project progress and report to KNEHC and the cofinancing agencies in accordance with the procedures required by the cofinanciers.
- (ix) Assist in settling disputes or differences of opinion that may arise between KNEHC and the contractors.
- (x) Provide support during clearance of construction claims, if any, and monitor the performance of substations during the warranty periods.
- (xi) Perform all duties as necessary and incidental to the satisfactory execution of the Project.
- (xii) Prepare a Project completion report.

c. Manuals and Documentation Update

- (i) Coordinate the preparation of O&M manuals including operating instructions during abnormal operation.
- (ii) Coordinate the updating of existing plant and equipment documentation and make corrections to drawings and other documents to comply with the modifications and design changes resulting from the rehabilitation program.

3. Implementation

11. The consulting services are expected to be carried out over a period of four years with estimated input of about 30 person-months by internationally recruited consultants. Experts in rehabilitation, reinforcement, and maintenance of power transmission and distribution systems are required. Experience in Russian equipment and technology will be an advantage.

4. Reporting

12. The following reports will be required during the rendering of the consulting services: (i) monthly progress reports, (ii) plant and equipment O&M manuals, and (iii) final report upon Project completion.

D. Overall Project Management

1. Objective and Scope of Work

13. The objective of the implementation consulting services for Part D is to assist the PIU in the day-to-day implementation of the Power and District Heating Rehabilitation Project with particular regard to the overall Project and contract management. The consultant will be responsible to KNEHC for the provision of assistance for such matters as bid evaluation, contract negotiations, preparation of procurement documents, project management, and contract management of the work associated with the various Project components. The consultant will also undertake to transfer technology to concerned personnel of KNEHC and the PIU.

2. Detailed Terms of Reference

14. The consultant will perform the following tasks:

a. Contracting Phase

- (i) Assist in preparing bid documents, including technical specifications, for procurement of goods and services.
- (ii) Assist in the evaluation of tenders and in awarding contracts to the most suitable bidders.
- (iii) Prepare draft contract documents for the various contracts.
- (iv) Participate in contract negotiations as requested by KNEHC.
- (v) Assist in the procurement of vehicles and equipment for the PIU office.

b. Project Implementation Phase

- (i) Prepare the overall budget; help monitor costs and maintain project accounting.
- (ii) Monitor project progress and report to KNEHC and the cofinancing agencies in accordance with the procedures required by the cofinanciers.
- (iii) Identify any problem areas during project implementation, propose remedial action, and report any outstanding issues to the PIU management.
- (iv) Assist in settling disputes or differences of opinion that may arise between KNEHC and the contractors.
- (v) Conduct training of KNEHC/PIU personnel in project management and contract management.
- (vi) Perform all duties as necessary and incidental to the satisfactory execution of the Project.
- (vii) Prepare a Project completion report.

c. Manuals and Documentation

Coordinate the preparation of project management and contract management manuals.

3. Implementation

15. The consulting services are expected to be carried out over a period of four years with an estimated input of about 40 person-months by internationally recruited consultants and 60 person-months by domestic consultants. Experts in project management and contract management of large power/district heating projects are required. Experience in power and district heating projects involving Russian technology will be an advantage.

4. Reporting

16. The following reports will be required during the rendering of the consulting services: (i) monthly progress reports, and (ii) final report upon Project completion.

E. Training

1. Objective and Scope of Work

17. The objective of the training consulting services is to assist KNEHC in developing a continuing training program for its staff in the areas of personnel management, general accounting, billing and collection, power system planning, and project management. The program will be aimed at improving the skills of middle management, lower management, and key staff with responsibilities focused on the indicated courses. The program will be implemented under the Power and District Rehabilitation Project over a period of about four years.

2. Detailed Terms of Reference

18. The consulting tasks will include the following:

- (i) Review the general training programs of KNEHC.
- (ii) Review the development and conduct of recent training programs provided to KNEHC by international agencies such as the US Agency for International Development, the European Union's program of Technical Assistance to the Commonwealth of Independent States, and the European Bank for Reconstruction and Development.
- (iii) Review data and information on personnel skills of KNEHC staff.
- (iv) Review data and information on estimated requirements for personnel skills improvement.
- (v) Review the adequacy of KNEHC's facilities for training in terms of buildings, training aids, equipment for preparing training materials, and trainee facilities.
- (vi) Prepare a training program for KNEHC staff in the areas of personnel management, general accounting, billing and collection, power system planning, and project management. Ensure proper coordination with other ongoing or recently conducted training programs.
- (vii) Identify incentives for participation in the training program.
- (viii) Prepare a system for evaluating the effectiveness of the courses.
- (ix) Identify an overseas training component under the training program.
- (x) Identify criteria for selecting trainees.
- (xi) Design a training course for trainers under the training program.
- (xii) Identify requirements for additional training facilities needed to implement the training program.
- (xiii) Identify computer hardware and software needed to support the implementation of the training program.
- (xiv) Prepare cost estimates for the implementation of the training program over a period of about four years and for the procurement of the recommended additional training facilities.

3. Implementation

19. The consulting services are expected to be carried out over a period of four months by an internationally recruited consultant with an estimated input of about eight person-months. The consultant should have experience in preparing and conducting training programs in the energy sector.

TERMS OF REFERENCE FOR STUDIES UNDER THE PROJECT

A. Billing and Collection Improvement

1. Objectives

1. The study will aim to assist the Kyrgyz National Energy Holding Company (KNEHC) to improve its consumer accounting system including billing and collection systems and procedures.

2. Scope of Work

2. The study will result in the formulation of recommendations for the improvement of the consumer accounting system for all the power and heat distribution cost centers of KNEHC and implementation of such a system in selected cost centers. In particular, the study tasks will include the following:

- (i) Review the organizational setup for carrying out the consumer accounting functions including meter reading, billing, collection, and actions on delinquent payments. Assess staffing arrangements, work loads, staff motivation, and maintenance of performance standards.
- (ii) Review the existing details and general and financial management aspects of the consumer accounting system and procedures, and identify weaknesses. Assess the existing operating manuals and guidelines, office equipment and, consumer accounting-related programs.
- (iii) Review the inputs of the consumer accounting system into the overall management information system. Assess the adequacy of data and information being provided in terms of accuracy, timeliness, and completeness.
- (iv) Recommend improvements to the consumer accounting system. Design an appropriate consumer accounting system compatible with the general accounting system and financial management system being designed under other ongoing studies. Prepare the required operating manual for the system. Indicate needs for appropriate automated software and appropriate hardware.
- (v) Using available hardware and software, conduct trial runs and implement the proposed consumer accounting system in selected cost centers.
- (vi) Conduct training courses on the proposed consumer accounting system for selected staff of KNEHC.
- (vii) Prepare an implementation plan for company-wide implementation of the recommended consumer accounting system. Prepare estimates of costs to implement the system including procurement of the recommended hardware and software and training of all concerned staff. Indicate the institutional endorsements required for the implementation plan. Estimate benefits anticipated from implementation of the recommended system. Prepare an implementation schedule.

3. Implementation Arrangements

3. The study will be executed by KNEHC. It is estimated that about 38 person-months of consulting services with expertise in financial systems analysis and power economics

will be required to undertake the study. Recruitment of consultants and procurement of materials and equipment for KNEHC will be carried out in accordance with the World Bank's procurement guidelines. The consultants will prepare and submit for review an interim report, a draft final report, and a final report. The study will take place over a maximum of 12 months.

B. Study of Power Sector Structure and KNEHC Organization and Management Assistance

1. Objectives

4. The primary objectives of the study are to help the Government (i) to develop an overall strategy for restructuring the power/heat sector with a view to improving sector efficiency and reliability/quality of supply, reducing the drain on the national budget, and opening the way to private sector involvement; and (ii) to begin to implement this strategy through restructuring and commercialization of KNEHC.

2. Scope of Work

5. Within KNEHC, the primary focus will be on (i) KNEHC's legal statutes and subsidiaries, (ii) the organizational framework and exercise of management/control over the subsidiaries, (iii) financial structure and performance, (iv) staffing and personnel management, and (v) management information systems. The study will be carried out in three phases: (i) sector strategy formulation, (ii) diagnostic study of KNEHC, and (iii) implementation of recommendations. The first two phases will proceed in parallel, with detailed work on the diagnostic phase proceeding only after preliminary agreement has been reached on the long-term structure for the power/heat sector. Execution of the third phase will be subject to agreement on the detailed findings of the diagnostic phase and the proposed plan of action prepared by the consultants.

a. Phase A. Sector Strategy Formulation

6. The consultants will define the structural and implementation details for the sector's transformation under KNEHC. This will involve clarification of the applicable principles and organizational options for sector reform and modernization to achieve the Government's objective of moving administration of the power/heat sector from a central planning mechanism to one that is more market oriented. The consultants will review the options for the longer term organization of the sector with a view to recommending a structure that promotes operational efficiency, efficient investment, reliability and quality of supply, accountability to the owners of its capital, and efficient use of electricity and district heating, and that takes into account the needs of consumers. The current and planned organization of the power/heat sector and existing plans for its restructuring, commercialization, corporatization, and privatization will be reviewed. The preliminary findings of the diagnostic study below will provide important inputs to this process in terms of identifying the problems and constraints of the present system.

7. Separation of power and heat activities, and unbundling of power into generation, transmission, and distribution will be among the restructuring options to be considered. Divestiture of assets/activities and scope for private sector participation, including independent power producers and local distributors, will also be considered. Criteria for evaluating the various options in the Kyrgyz context will be developed and used in assessing the options. The

consultants will develop two or three alternative structures for discussion with the Government, KNEHC, and concerned aid agencies in a workshop; these will also be presented in the form of an interim report. Once the basic structure is agreed upon, the consultants will prepare an outline plan for carrying out the restructuring including the transitional stages.

b. Phase B. Diagnostic Study of KNEHC

i. Legal Framework

8. The consultants will examine the general legal framework in the Kyrgyz Republic governing corporations, state enterprises, and the power sector. The consultants will also examine the statutes of KNEHC and its subsidiaries. The consultants will study in particular (i) ownership, (ii) corporate policies, (iii) the repartition of powers between the owners and the managers, and (iv) auditing functions.

ii. Organizational Framework and Subsidiaries' Control

9. The consultants will investigate in detail (i) the performance of the organization under the present structure, (ii) the control exercised by the holding company over the subsidiaries, (iii) policy formulations, and (iv) existing organizational manuals and management orders.

iii. Financial Structure and Performance

10. The consultants will address among others the following considerations in the financial restructuring of KNEHC: (i) review of recommendations on revaluation of existing assets; (ii) reflecting debts properly in the balance sheets; (iii) setting dividend targets to ensure a return on Government equity; (iv) using financial targets to drive tariff increases; and (v) separating the various operations, e.g., district heating and power supply and generation, transmission, and distribution, and establishing cost/profit centers accordingly.

iv. Staffing and Personnel Management

11. The consultants will examine the current practices of KNEHC in terms of personnel management, salaries and benefits, training, career development, advancement, and terminations. The findings on the personnel study will focus on (i) setting of staffing strategy and policy; (ii) determination of manpower requirements; (iii) restructuring of salaries, benefits, and other incentives; (iv) preparation of job descriptions for senior and medium levels; (v) assessment of training requirements in the different disciplines, considering the recommended organizational framework; and (vi) elaboration of a strategy to reduce redundant staff.

v. Management Information Systems

12. In close cooperation with other ongoing studies related to financial management system improvement, the consultants under this study will (i) identify the main characteristics of suitable technical and financial management information systems, (ii) identify a number of alternative systems with their costs and benefits, and (iii) prepare detailed recommendations including the need to prepare organization manuals and procedures and provide staff training.

vi. Action Plan for Implementation

13. Following the diagnostic phase, the consultants will formulate a detailed report on the conclusions of the diagnostic study together with recommendations. They will also prepare an action plan indicating the recommended methodology and step-wise program to proceed with implementation. Any need for the acquisition of additional hardware/software should be identified. The consultants should also specify any measures to be taken by KNEHC/Government that are essential to allow smooth implementation.

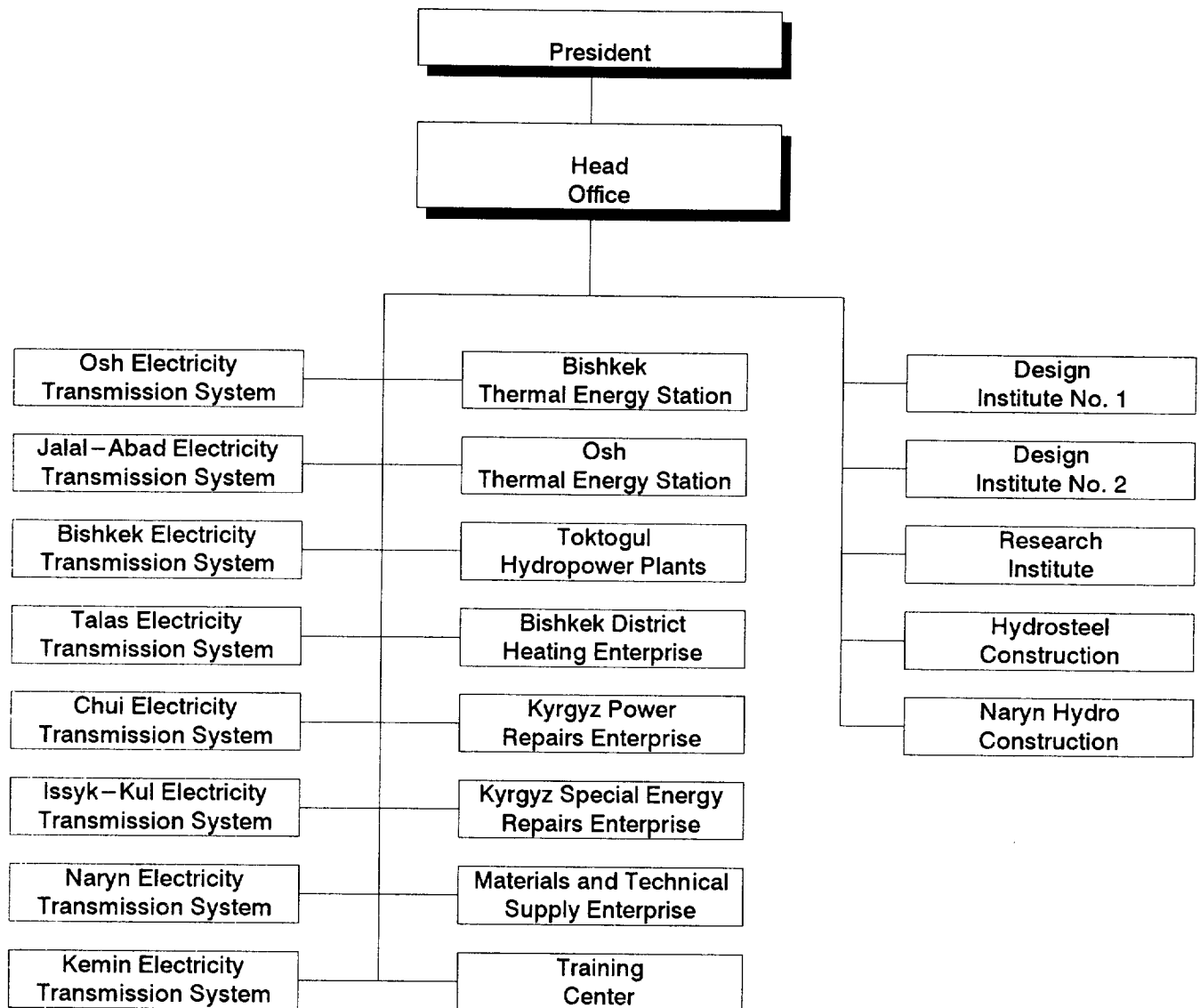
c. Phase C. Implementation of Recommendations

14. Following Government and KNEHC agreement on the program, the consultants will proceed with the implementation of the recommendations in close collaboration with KNEHC staff and in accordance with an agreed upon time schedule. The consultants will provide on-the-job training to the maximum extent possible during the implementation phase. It is expected that the consultants' support will extend over a period of 18 months, with the presence of consultant staff declining as Kyrgyz counterparts take over.

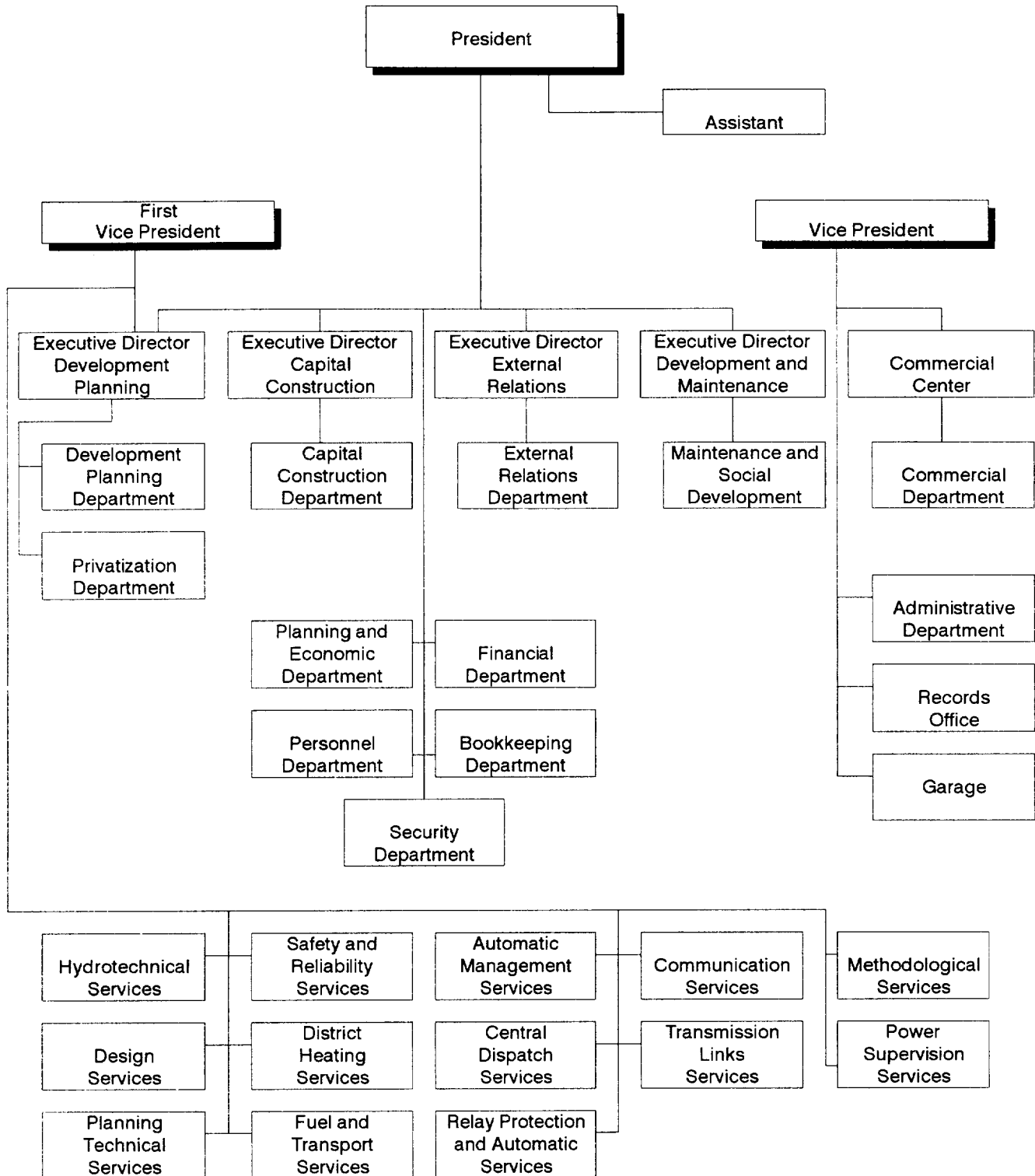
3. Implementation Arrangements

15. The consultants will need to work closely with KNEHC and Government officials throughout the period of assistance, and will need to spend a major portion of their time in the Kyrgyz Republic. Joint working groups should be formed for the various tasks. The details for the organization of the work, including the composition of the working groups for the sector strategy formulation and diagnostic study of KNEHC, will be specified in the inception report. The focus of the Phase A work will be policy issues, hence requiring expertise in power/heat sector restructuring, regulation, and privatization. The focus of the Phases B and C work will be organization and management issues, hence requiring expertise in business management, finance, staffing/personnel, and legal and information systems. The international experts should have considerable experience in countries of the Former Soviet Union and Central/Eastern Europe. Domestic consultants should be used to the maximum extent possible.

16. It is estimated that about 40 person-months of international consultant input will be required from experts in organization, general management, and financial management of utilities in the power and heat subsectors. The overall time frame is estimated at 24 months, with deliverables as follows: inception report at the end of month 1, Phase A interim report in month 3, the agreed upon restructuring plan in month 4, Phase B report by month 5, and the final report by month 24. A workshop for Phase A will be held in month 3 and another for Phase B in month 5. Monthly progress reports will be submitted.

ORGANIZATION CHART OF THE KYRGYZ NATIONAL ENERGY HOLDING COMPANY

**ORGANIZATION CHART OF HEAD OFFICE
KYRGYZ NATIONAL ENERGY HOLDING COMPANY**



FINANCIAL PERFORMANCE AND PROJECTIONS OF KNEHC

1. The financial operations of the Kyrgyz National Energy Holding Company (KNEHC) were projected based on the major assumptions described below. The projected financial statements are given in Tables 1-3.

A. General

1. Demand Forecast

2. The projected demands for electricity and district heating services of KNEHC are based on estimates made by KNEHC in line with a conservative projection of economic growth.

2. Capital Investment Program

3. The capital investments considered in the projections are based on least cost analysis as prepared by KNEHC with the assistance of consultants. The Kambarata 2 hydropower project is included in the long-term development plan, but Kambarata 1 is not.

3. Prices, Inflation, and Exchange Rate

4. The Som was introduced in November 1993 with an initial exchange rate of Som4.0 to \$1.00. It subsequently depreciated to about Som10.50 per \$1.00 by September 1994 and had stabilized at this rate by the first half of 1995. An exchange rate of Som11.00 per \$1.00 is assumed throughout the projection period. Domestic inflation has been very high in the recent past. The local inflation rate in 1995 was estimated to be about 30.0 percent; the following annual rates are projected: 15.0 percent in 1996, 9.0 percent in 1997, 4.1 percent in 1998, and 2.6 percent in 1999 and thereafter.

B. Income Statements

1. Revenues

5. Domestic energy sales are based on KNEHC estimates. Exports to Kazakhstan are assumed at 1,500 gigawatt-hour per year from 1996 with an average tariff of \$0.02/ kilowatt-hour. Average domestic energy and district heating tariffs are assumed to be adjusted to (i) cover cash operating costs in 1996, (ii) cover operating costs including depreciation by 1997, and (iii) enable a self-financing ratio of at least 30 per cent starting in 1998.

2. Fuel Costs

6. Fuel consumption is based on projected requirements for system operations. Fuel price increases are estimated in accordance with World Bank projections of the international prices of petroleum products.

3. Other Operating Costs

7. Operation and maintenance costs, personnel costs, general and administrative expenses, and other expenses are all assumed to increase in accordance with inflation.

4. Depreciation

8. Depreciation is calculated on a straight-line basis at the annual rate of 3 per cent of the average fixed assets in operation.

5. Interest Expenses

9. Interest expenses on outstanding long-term debts are calculated based on the indicated terms and conditions for committed loans.

6. Income Tax

10. Income tax is calculated as the higher of either 0.8 percent of gross billings or 30 percent of taxable income.

C. Balance Sheets and Cash Flow Statements**1. Fixed Assets**

11. The projected fixed asset accounts are calculated based on an annual revaluation of fixed assets. The capital formation inflators are assumed to correspond to international inflation rates based on the projected manufacturing unit value indexes calculated by the World Bank.

2. Other Long-term Debts

12. It is assumed that, to cover financing gaps in the implementation of its long-term capital investment program, KNEHC will have access to long-term debts with similar terms as the average of its present committed external borrowing program.

3. Accounts Receivable

13. Collection efficiency is estimated to improve such that accounts receivable will amount to about 2.0 months of sales by 1997.

4. Inventories

14. Inventories are estimated to increase at the rate of inflation.

5. Accounts Payable

15. Accounts payable are estimated at about 3 months of cash operating requirements.

6. Cash Balance

16. The cash balance is maintained at about two months of requirements for cash operating expenses.

Table 1: Projected Income Statements
Kyrgyz National Energy Holding Company
(Som million)

	Actual		Estimated	Projected						
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SALES DATA										
Electricity										
Sales, GWh										
Domestic	7986	7830	7800	8000	8200	8450	8725	9000	9275	9550
Export	1023	2505	1486	1500	1510	1520	1530	1535	1540	1540
Average Revenue										
Domestic	2.3	6.7	8.3	14.8	22.1	28.8	37.4	48.6	48.6	48.6
Export	12.0	29.6	28.3	44.0	45.2	46.3	47.4	48.6	49.8	51.1
Domestic Tariff										
Increase (%)				78.0	49.6	30.0	30.0	30.0	0.0	0.0
District Heating										
Sales ('000 GCal)	3967	2698	2740	3100	3300	3280	3240	3200	3200	3200
Average Revenue										
(Som/GCal)	16	46	61	138	207	212	217	222	228	234
Tariff Increase (%)			31.0	126.9	49.6	2.4	2.4	2.5	2.5	2.5
Total KNEHC										
Return on Net										
Fixed Assets (%)	117.6	156.5	-55.3	-3.5	-0.4	1.2	3.3	6.7	7.1	7.4
Self Financing Ratio (%)			-59	-20	163	173	187	251	294	351
Operating Income			-181	-283	0	389	1088	2173	2269	2354
REVENUES										
Electricity	318	1226	1069	1843	2497	3134	3988	5120	5275	5428
District Heating	65	126	167	429	683	454	448	443	443	443
Other	13	79	102	117	128	133	137	140	144	148
Subtotal	395	1430	1338	2389	3308	3721	4573	5704	5862	6018
EXPENSES										
Fuel	62	342	699	1175	1207	1126	1196	1155	1132	1116
Purchases	4	14	7	8	9	9	10	10	10	10
Operation and Maintenance	49	361	431	495	540	562	577	592	607	623
Salaries and Wages	11	35	45	51	56	58	60	61	63	64
General Administration	30	195	271	312	340	353	363	372	382	392
Non Allocated	12	41	53	133	145	151	155	159	163	167
Depreciation	5	6	13	499	1013	1072	1125	1183	1237	1293
Subtotal	173	993	1519	2672	3309	3332	3484	3531	3593	3665
OPERATING INCOME	222	437	-181	-283	0	389	1088	2173	2269	2354
Interest		1	5	22	51	70	164	243	219	195
Other Expenses			-1	14		0	0	0	0	0
Taxable Income	222	435	-185	-320	-51	319	924	1929	2049	2159
Income Tax	3	54	11	19	26	96	277	579	615	648
NET INCOME	219	382	-196	-339	-77	223	647	1351	1434	1511
RATIOS										
Operating Ratio (%)	44	69	114	112	100	90	76	62	61	61
Return on Net										
Fixed Assets (%)	117.6	156.5	-55.3	-3.5	-0.4	1.2	3.3	6.7	7.1	7.4

Table 2: Projected Balance Sheets
Kyrgyz National Energy Holding Company
(Som million)

As of 31 December	Actual		Estimated	Projected						
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
ASSETS										
Current Assets										
Cash	5	7	559	482	1280	1926	3271	5286	7716	10189
Accounts Receivable	323	870	660	786	544	612	752	938	964	989
Stocks	30	217	282	325	354	369	378	388	398	408
Others	48	258	336	386	421	438	449	461	473	485
Subtotal	407	1352	1837	1978	2599	3344	4850	7072	9551	12072
Gross Fixed Assets	256	390	522	38103	40397	42689	44494	47157	48637	51504
Accumulated Depreciation	70	88	116	19287	21393	23159	24867	26681	28595	30614
Net Fixed Assets	186	302	406	18816	19004	19530	19627	20476	20042	20890
Work in Progress										
Rehabilitation Project				121	473	878	1122			
Other Projects	127	222	366	787	1181	933	1107	1932	2613	1780
Other Assets	17	27	27	27	27	27	27	27	27	27
Total Assets	737	1902	2635	21728	23284	24712	26733	29507	32232	34768
LIABILITIES AND EQUITY										
Current Liabilities										
Short-term Debts	8	2	2	2	2	2	2	3	3	3
Accounts Payable	400	867	753	725	574	565	590	587	589	593
Others	3	13	17	19	21	22	22	23	24	24
Current Portion of										
Long-term Debts	7	8	6	0	42	146	284	295	305	305
Subtotal	419	889	777	746	639	735	899	907	920	925
Long-term Debts										
Committed Loans	10	6	131	493	730	839	894	793	686	579
Rehabilitation Loan	0	0	0	102	399	740	882	818	749	681
Other Loans	0	0	826	1093	1181	1171	1647	2672	3556	4176
Subtotal	10	6	957	1687	2310	2749	3424	4283	4991	5436
Equity										
Equity	308	1007	1007	1007	1007	1007	1007	1007	1007	1007
Retained Earnings			-196	-534	-612	-388	259	1609	3044	4555
Revaluation Surplus			90	18822	19940	20609	21146	21701	22270	22846
Subtotal	308	1007	901	19295	20335	21227	22411	24317	26321	28407
Total Liabilities and Equity	737	1902	2635	21728	23284	24712	26733	29507	32232	34768
RATIOS										
Current Ratio	1.0	1.5	2.4	2.7	4.1	4.6	5.4	7.8	10.4	13.0
Accounts Receivable (days)	298	222	180	120	60	60	60	60	60	60
Debt/Debt plus Equity (%)	0.0	0.0	47.8	5.4	5.5	5.2	6.8	9.9	11.9	12.8

Table 3: Projected Cash Flow Statements
Kyrgyz National Energy Holding Company
(Som million)

	Actual		Estimated	Projected						
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SOURCES										
Internal Sources										
Net Income before										
Interest			-191	-316	-27	293	811	1594	1654	1706
Depreciation			13	499	1013	1072	1125	1183	1237	1293
Subtotal			-177	182	987	1366	1937	2777	2890	2999
Borrowings										
Committed			131	362	279	150	150	0	0	0
New			826	201	0	0	587	1107	874	529
Rehabilitation Loan			0	102	298	340	202	0	0	0
Others			0	66	87	94	19	47	139	220
Total Sources			780	913	1651	1951	2895	3931	3904	3748
APPLICATIONS										
Capital Expenditures										
Rehabilitation Project				121	345	390	222			
Other Projects			171	597	486	696	882	1179	914	732
Other Assets										
Debt Service										
Committed Loans										
Principal			8	6	0	42	42	95	101	107
Interest			5	22	51	70	81	82	73	63
New Loans										
Principal			0	0	0	0	104	129	129	129
Interest			0	0	0	0	83	95	85	74
Rehabilitation Loan										
Principal				0	0	0	0	60	64	68
Interest				0	0	0	0	66	62	57
Change in Working										
Capital			43	244	-29	108	135	209	45	44
Total Applications			227	990	853	1306	1549	1916	1474	1275
NET CASH INFLOW			552	-77	799	645	1345	2015	2430	2473
CASH, BEGINNING			7	559	482	1280	1926	3271	5286	7716
CASH, ENDING			559	482	1280	1926	3271	5286	7716	10189
RATIOS										
Debt Service Coverage Ratio			-13.9	6.3	19.5	12.2	15.8	15.7	16.6	17.6
Self Financing Ratio (%)			-58.7	-20.1	162.8	172.8	187.2	250.6	294.4	351.4

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION REPORT

A. Introduction

1. A detailed analysis of the Project's environmental impacts carried out by Burns and Roe Enterprises, Inc. of USA from October 1994 to October 1995 as part of a feasibility study financed by the US Agency for International Development is the basis for this summary initial environmental examination report. As Project cofinancier, IDA fielded an environment specialist¹ in September 1995 to review and assess the project environmental impact analysis. A detailed description of the Project is given in Appendix 4.

B. Description of the Existing Environment

2. The Kyrgyz Republic is a mountainous country, with more than 94 percent of its land at elevations of 1,000 meters (m) above sea level and 40 percent above 3,000 m. The country is divided into two parts by the Pamirs mountain range in the south and the Tien Shan in the north. Melting snow from the mountains is a major water source for the country and the otherwise arid areas of Central Asia. The Naryn River, which becomes the Syr Darya river in Uzbekistan, is a major source of hydropower and water supply for the country as well as for the adjacent countries of Kazakhstan and Uzbekistan. A number of freshwater lakes located in the mountain areas are fed by glacial melt. The low-lying areas at elevation of 400-1,200 m are mostly desert and semidesert, portions of which in recent years have been irrigated and extensively cultivated with cotton, grains, and cash crops. Only 7 percent of the whole country is arable land. Non-irrigated areas of the steppes are used for grazing.

3. The climate is continental, with hot, dry summers and cold, snowy winters. The temperature difference between the lowlands and the highlands can be as much as 15°C. The average annual rainfall ranges from 300 to 600 millimeters. The high elevations, wide variations in temperature, and enclosures created by the mountain ranges are highly conducive to the formation of air pollution episodes, especially in winter, when coal with minimal pretreatment is extensively used for power generation and district heating. The Bishkek district heating plant alone discharges 30-40 metric tons per day of air pollutants and practically blankets the whole city with smoke during winter. While the plant managers and city administrators are aware of the problem, the financial resources are limited to institute corrective measures.

4. The country has an area of 198,500 square kilometers with a total population of 4.4 million people. The country is relatively highly urbanized with 2.7 million people living in urban centers, mostly in the capital of Bishkek and the southern city of Osh. The population growth rate is 1.6 percent per year. Infant mortality has increased in recent years to 47.8 per thousand births from a low of 29.6 per thousand births in 1991 because of problems in the economy and the corresponding decline in public health services. Life expectancy has also declined from 64.2 years in 1991 to 63.5 years at present for males, and from 72.6 to 72.2 years for females.

¹ Viren Sirohi, Environmental Specialist, The World Bank.

C. Potential Environmental Impacts and Mitigating Measures

5. The Project environmental impacts are mostly positive. The Project will rehabilitate the instrumentation and control in the power plant to improve the combustion efficiency, which will consequently reduce the unburnt hydrocarbons discharged into the atmosphere. The Project will provide dust control and fire control in the coal stock pile, wastewater treatment plant to remove the oil and grease from the bearing cooling water, rehabilitate the electrostatic precipitator to remove the smoke and dust emission. Rehabilitation of the district heating system will replace corroded pipes and minimize accidents from bursting of hot water pipes. The Project will also expand the ash disposal pit, improve the wind breakers, sod filled areas and plant trees in the buffer zone.

6. Samples of the soil in the power plant site and substations have been carried out and it was established that the site is not contaminated with polychlorinated biphenyl nor heavy metals. Some sections of the power plant and the substations have been contaminated with oil and grease due to spillage and improper handling. The contaminated soil will be scrapped and disposed in a secured landfill.

7. The main environmental concern of the Project is that during the decommissioning of the boilers and heat exchanger where asbestos is extensively utilized as insulators, there may be some possible negative effects. The Project includes provision of protective clothing, a system for removal of asbestos from working areas and the containment and packaging of the asbestos and asbestos contaminated materials. The discarded asbestos and asbestos contaminated materials will be disposed of in a secured landfill.

D. Findings and Recommendations

8. In addition to the improvement in the pollution control facilities, the Project will provide air and water monitoring equipment and training for personnel on environmental management. Workers handling asbestos and asbestos contaminated materials will undergo short training on the risk, proper handling, decontamination and emergency procedures before they start working.

E. Conclusion

9. The Project will have many positive effects on the environment. The improvement of the efficiency of the cogeneration plant and the district heating network will reduce the amount of fuel and the air pollutant emission. Improvement in the pit management will reduce the groundwater and dust pollution and improve the aesthetics of the area with the development of the greenbelt. Removal and replacement of corroded hot water pipe distribution system will reduce the risks of bursting hot water pipes. The possible negative environmental impact of the Project arises during the removal of asbestos and asbestos contaminated materials from the boilers and heat exchangers which could be properly mitigated by provision of suitable protective devices, training of personnel, containment and disposal of the waste materials in a secured landfill. As the negative environmental impact of the Project could be properly mitigated and the Project has considerable positive environmental impacts, a detailed environmental impact assessment is not required.

SOCIAL SAFETY NET PROGRAM

A. Introduction

1. Tariffs for heat, hot water, electricity, gas, and coal are being increased as the economy of the Kyrgyz Republic adjusts itself to market-oriented operations. To mitigate the impact of higher utility costs on low-income consumers, the Government would establish a suitable social safety net program, the key element of which would be transparent subsidies. Such a social safety net is being designed on the basis of the social assessment carried out as part of the preparation of the Project. In this context, a household survey was conducted in June-July 1995 aimed at district heating consumers in Bishkek. The survey indicated that the target beneficiaries of subsidies under the social safety net program should be (i) low-income residential users of district heating; (ii) low-income households using natural gas for heating; and (iii) low-income households using coal, firewood, and dung for heating.

B. District Heating and Hot Water

2. Approximately half of the urban population in Bishkek is provided with heat from the district heating system. About 81 percent of the residential district heating consumers supplement heat from district heating with electrical heat. About 72 percent are also connected to the natural gas network, but gas is used exclusively for cooking. At the current residential tariff for district heating (about Som15/gigacalorie [Gcal] in mid-1995), a residential household would pay on average about Som20-50 per month for heat. To recover costs, the district heating tariffs will have to be increased to about Som170/Gcal, which would mean an average increase of about eight times for residential users. Low-income users will be hardest hit by such an increase, considering that the average income of the bottom 45 percent of residential users is only about Som330 per month.

3. The social impact of higher tariffs for heat and hot water can be eased by subsidizing the tariff for low-income consumers. The subsidy scheme would aim to (i) protect poor and vulnerable groups while ensuring that they pay what they can afford, and (ii) cause higher income groups to pay the full cost of supply. In the design of the subsidy scheme, the Kyrgyz National Energy Holding Company (KNEHC) should not perform social functions that constrain business performance; on the other hand, genuine social responsibilities should be assigned to agencies that are expressly qualified to assume them. It is generally accepted that affordability by residential consumers to pay for heat would be limited to at most 30 percent of household income and expenditure for heat exceeding 30 percent of income should be subsidized. Of the 200,000 district heating residential household users, about 70,000 would be eligible for a subsidy on this basis. The annual cost of the subsidy would be about Som56 million.

4. The proposed implementing agency for administering the subsidy program is the Ministry of Labor and Social Protection (MLSP), which is currently administering other subsidy programs, such as the Common Monthly Subsidy targeted at households with monthly incomes below Som68. Eligible residential consumers would submit applications for the energy subsidy for processing to MLSP. The subsidy would be given in the form of coupons to be used against payment of the heating bills.

C. Natural Gas

5. A subsidy program would be established for the urban residential clients of the natural gas system. These consumers, who live in isolated private houses, use natural gas for heating and cooking, but do not use any other fuel and do not have access to district heating. The administrative procedures for implementing the subsidy program for natural gas users would be the same as those for the program for district heating. Using the same income parameters, it is estimated that about 20,000 households of the 70,000 household consumers using natural gas would be eligible for a subsidy. The total cost of this subsidy program would be about Som16 million per year.

D. Coal

6. Vulnerable groups of the rural population using coal, firewood, and dung for cooking and heating should also benefit from a subsidy program involving coal pricing. With the recent rise in coal prices, there has been a shift by some rural people from coal to firewood as an energy source, which is resulting in serious environmental damage. The subsidy program would be aimed at households using coal, dung, or firewood as an energy source. The subsidy would be in the form of a voucher to be used against the purchase of coal. It is estimated that about 175,000 rural households and 21,000 urban households would qualify as beneficiaries of this program, and the annual cost of the program would be about Som78 million.

E. Electricity

7. The impact of higher electricity tariffs on low-income groups would be addressed with a lifeline tariff of about Som0.15/kilowatt-hour (kWh) for consumption, not exceeding 100 kWh per month; the rate beyond the lifeline would be increased to recover all financial costs associated with supply of electricity.

F. Public Participation

8. The subsidy programs discussed above will need public support to be successful in meeting their objectives. A public information campaign would be mounted to (i) inform the public of the programs; (ii) consult beneficiaries and other concerned parties to enable transparency in program implementation; and (iii) enable proper supervision, monitoring, and control of program implementation.

G. Possible Source of Funds for the Subsidy Program

9. It is estimated the total direct subsidy for consumers of district heating, natural gas, and coal would amount to Som150 million per year. One possible source of financing for the energy utilities subsidy program would be an additional tax on gasoline. In 1994, about 300,000 metric tons (375 million liters) of gasoline were consumed. At the current retail price of about Som3.20/liter (\$0.30), an increase of Som0.40/liter or 12 percent would be required.

PROJECT FINANCIAL AND ECONOMIC ANALYSIS

1. The Project has been subjected to financial and economic analysis to determine its financial viability and its economic justification. The financial analysis is conducted from the point of view of Kyrgyz National Energy Holding company (KNEHC) operations; the economic analysis considers the impact of the Project on the country's economy. The notes and assumptions used in the analysis to follow.

A. Costs

1. Fuel Costs

2. The unit costs of the different kinds of fuel used in the cogeneration plant in Bishkek are shown in Table 1 in both financial and economic terms.

2. Unit Production and Operating Costs

3. The economic costs to produce a unit of electricity and a unit of heat using various generation modes are shown in Table 2. For electricity, the cost comparison includes hydroelectric plants, coal-fired plants, and cogeneration thermal plants; for heating, the alternatives considered include cogeneration, heat-only boilers using coal, and heat-only boilers using fuel oil.

B. Benefits

4. For incremental new electricity users, the economic benefit is valued based on the willingness of the present unserved population to pay for this service. The willingness to pay is calculated as shown in Table 3.

C. Financial and Economic Internal Rates of Return

5. The detailed assumptions and calculations used in determining the internal rates of return of the three major Project components are presented in Tables 4-6.

Table 1: Fuel Prices

Fuel	Unit	Unit Cost (\$/unit)	Heat Content (Gcal/unit)	Comparative Cost (\$/Gcal)	Fuel Mix In TES1 (%)
Economic Price					
Fuel Oil	t	95	9.6	9.95	10
Natural gas	1000 m ³	77	8.2	9.39	15
Coal	t	36	4.2	8.81	75
Weighted Average				9.01	
Financial Price					
Fuel Oil	t	108	9.6	11.31	10
Natural gas	1000 m ³	94	8.2	11.46	15
Coal	t	32	4.2	7.62	75
Weighted Average				8.57	

Table 2: Heat and Power Generation Economic Levelized Cost Analysis

Item	Hydro— electric Plant	Coal Fired Plant	Cogeneration Plant Elec— tricity	Heat	Heat—only Boiler (Coal)	Peak Heat— only Boiler (Fuel Oil)	Individual Heat—only Boiler
Ratings and Usage							
Unit capacity (kW)	1	1	1				
Unit capacity (1 Tcal/hr)				1	1	1	1
Plant factor (%)	45	60	60	50	50	25	37
Annual energy output							
Electricity (kWh)	3,942	5,256	5,256				
Heat (Gcal)				4.38	4.38	2.19	3.24
Fuel conversion efficiency (%)		35	45	115	85	85	70
Economic life (years)	50	25	25	25	15	15	15
Investment Costs							
Investment (\$/kW) ^a	900	1,000	1,000				
Investment (\$/Gcal/hr)				90	110	90	120
Construction period (years)	6	5	5	5	3	3	3
Disbursement premium ^b	25	20	20	20	13	13	13
Total investment (\$/kW)	1,127	1,203	1,203				
Total investment (\$/Gcal)				108	124	102	136
Annualized Investment Cost (\$/year) ^b	113.7	132.5	132.5	11.9	16.3	13.4	17.8
Unit cost (\$/kWh)							
Electricity (\$/kWh)	0.029	0.025	0.025				
Heat (\$/Gcal)				2.723	3.730	6.104	5.499
Operation and Maintenance Costs							
Per cent of capital cost (%)	1	3	3				
Annual cost (\$/year)	9.00	30.00	30.00				
Unit cost (\$/kWh)							
Electricity (\$/kWh)	0.002	0.006	0.006				
Heat (\$/Gcal)				4.000	4.000	3.000	2.220
Fuel Costs							
Unit cost of fuel (\$/MWh)		7.749	7.749	7.749	7.577	8.557	7.749
Unit cost of fuel (\$/Gcal)		9.01	9.01	9.01	8.81	9.95	9.01
Conversion efficiency (%)		35	45	115	85	85	70
Annual cost (\$/year)		116	91	34	45	26	42
Unit cost (\$/kWh)							
Electricity (\$/kWh)		0.022	0.017				
Heat (\$/Gcal)				7.835	10.365	11.706	12.871
Alternative Energy Cost, Economic							
Electricity (\$/kWh) ^c	0.031	0.053	0.048				
Heat (\$/Gcal)				14.56	18.10	20.81	20.59

^a The capital cost of a hydroelectric plant is based on the cost of the next hydropower project.

^b Discount rate is assumed as 10 per cent.

^c Weighted average electricity generation cost based on 84 percent hydro and 16 percent thermal is \$0.034/kWh.

Table 3. Willingness To Pay for Electricity

Item	Unit	Kerosene Lamp	Diesel 250KW
Assumptions			
Capacity	kW	0.05	250
Capital cost	\$	15	125000
Economic Life	years	10	15
Operating Cost	% of capital cost	3	3
Fuel Consumption	liters/kWh	0.7	0.35
Fuel Cost	\$/liter	0.27	0.26
Plant Factor	%	17	36
Energy Output	kWh	75	780000
Unit Cost			
Capital (at 20% interest)	US cent/kWh	4.77	3.43
Operating Cost	US cent/kWh	0.60	0.48
Fuel Cost	US cent/kWh	18.90	9.10
Total Cost	US cent/kWh	24.27	13.01
Willingness to Pay			
Residential ^a	US cent/kWh	6.51	
Industrial and Others ^b	US cent/kWh		4.08
Average ^c	US cent/kWh		5.05

^a Average tariff is US cent0.57/kWh; demand curve coefficient is 33 percent.

^b Average tariff is US cent1.06/kWh; demand curve coefficient is 33 percent.

^c At 40 percent residential and 60 percent industrial and others.

Table 4: Financial and Economic Analysis – Bishkek TES1 Rehabilitation

[illegible]

Table 5: Financial and Economic Analysis – District Heating Rehabilitation

[illegible]

Table 6: Financial and Economic Analysis – Transmission and Distribution Reinforcement

Item	Unit	Net Present Value												
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2024	
ASSUMPTIONS														
System Loss Reduction														
Energy loss reduction	GWh				49.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0
Capacity loss reduction	MW					27.0								
Outage Reduction	GWh				3	6	34	34	34	34	34	34	34	34
Network Expansion														
New energy sales	GWh					50	100	130	130	130	130	130	130	130
Benefit Values														
Outage cost	US\$/kWh	20.00												
Willingness to pay	US\$/kWh	5.10												
Economic cost														
Generation	US\$/kWh	3.39												
To consumer	US\$/kWh	5.00												
Real tariff	US\$/kWh		1.9	2.2	2.7	3.4	4.1	4.1	4.1	4.3	4.6	5.0	5.0	5.0
Financial generation cost	US\$/kWh	3.37												
FINANCIAL INTERNAL RATE OF RETURN (\$ million)														
Incremental Cash Inflow														
New sales (willingness to pasy)	38.0				0.0	1.7	4.1	5.3	5.3	5.6	6.0	6.5	6.5	6.5
Outage reduction	10.0				0.1	0.2	1.4	1.4	1.4	1.5	1.6	1.7	1.7	1.7
Energy loss reduction	23.7				1.7	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total	71.8				1.7	5.2	8.7	10.0	10.0	10.3	10.8	11.5	11.5	11.5
Incremental Cash Outflow														
Capital cost	22.6		4.3	10.0	10.0	4.3								
Operating cost	2.1				0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Outage energy cost	7.3				0.1	0.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	31.5				0.0	1.9	3.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total	63.5		4.3	10.0	10.4	6.7	5.3	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Net Cash Flow	8.3		-4.3	-10	-8.6	-1.5	3.5	3.6	3.6	3.9	4.4	5.1	5.1	5.1
Financial Internal Rate of Return	%	13.6												
ECONOMIC INTERNAL RATE OF RETURN (\$ million)														
Incremental Benefits														
New sales revenue	41.9				0.0	2.6	5.1	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Outage reduction	43.4				0.6	1.2	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Energy loss reduction	23.8				1.7	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total	109.2				2.3	7.0	15.2	16.7	16.7	16.7	16.7	16.7	16.7	16.7
Incremental Costs														
Capital cost	22.6		4.3	10.0	10.0	4.3								
Operating cost	2.1				0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Outage enrgy cost	7.4				0.1	0.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Energy cost	31.7				0.0	1.9	3.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total	63.7		4.3	10.0	10.4	6.7	5.3	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Net Benefits	45.5		-4.3	-10	-8.1	0.3	9.9	10.3	10.3	10.3	10.3	10.3	10.3	10.3
Economic Internal Rate of Return	%	0.0	28.5											