Kyrgyz Republic
Ministry of Energy and Industry

DATA COLLECTION SURVEY

ON

SMALL HYDROPOWER DEVELOPMENT IN CHUI OBLAST, KYRGYZ REPUBLIC

FINAL REPORT

JUNE 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO ELECTRIC POWER SERVICES CO., LTD.
CTI ENGINEERING INTERNATIONAL CO., LTD.

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【 Contents 】

【 List of Tables 】

【 List of Figures 】

【 Abbreviations 】

ADB	Asian Development Bank
bil.	billion
C.A.	Catchment Area
CAPS	Central Asia Power System
CASA1000	Central Asia South Asia Electricity Trade and Transmission Project
CB	Circuit Breaker
CHP	Combined Heat and Power Station
CIS	Commonwealth of Independent States
CL	Cable Line
CO2	Carbon Dioxide
DC	Direct Current
DFR	Department For Regulation, MEI
Directorate	Directorate for the Small and Medium Scale Power Generation Projects
DisCos	Distribution Companies
DPCC	Development Partners' Coordination Council
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ExIm Bank	Export-Import Bank
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographical Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit, the German Society for International Cooperation
GWh	Gigawatt Hour
HPP	Hydro Power Plant
IDB	Islamic Development Bank
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IPP	Independent Power Producer
IUCN	International Union for Conservation of Nature and Natural Resources
JICA	Japan International Cooperation Agency
JSC Chakan GES	Joint Stock Company Chakan GES
JSC EPP	Joint Stock Company Electric Power Plants
JSC Jalal-Abatelectro	Joint Stock Company Jalal-Abatelectro
JSC NEGK	Joint Stock Company National Electricity Grid of Kyrgyzstan
JSC Oshelectro	Joint Stock Company Oshelectro
JSC Severelectro	Joint Stock Company Severelectro
JSC Vostokelectro	Joint Stock Company Vostokelectro
KfW	Kreditanstalt für Wiederaufbau
km	Kilometer
KR	Kyrgyz Republic
KSTC	Kyrgyz Science Technology Center “Energy ”
kV	Kilovolt
MEI	Ministry of Energy and Industry
mil.	million
MVA	Mega volt ampere
MW	Megawatt

OHDL	Overhead Distribution Line
OHS	Occupational Health and Safety
OJT	On the Job Training
PCB/PCBs	Polychlorinated Biphenyls
S/S	Substation
SAEPF	State Agency on Environment Protection and Forestry
SHPP	Small Hydroelectric Power Plant
SIETS	State Inspectorate for Environment and Technical Safety
SPF	State Property Fund
SPO	Special Purpose Organization
SRS	State Registration Service
TA	Technical Assistance
TL	Transmission Line
TOR	Terms of Reference
Tr	Transformer
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
USAID	U.S. Agency for International Development
USD	U.S. dollar
WTO	World Trade Organization
WB	World Bank

Chapter 1 Outline of the Survey

1-1 Purpose of the Survey

Kyrgyz Republic (hereinafter "Kyrgyzstan") is highly dependent upon existing hydropower generations and also has abundant of hydropower potentials in the country. The purpose of this survey is to study and justify possibilities of a small hydropower development as Japan ODA project in Chui Oblast of Kyrgyzstan. In the survey, necessitated and latest information are collected and analyzed for a future JICA's effective approach to the abovementioned small hydropower development in Kyrgyzstan.

1-2 Target Area of the Survey

The target area of the survey is Chui Oblast, as shown in Figure 1-2-1, in which there are abundant hydropower potentials of the country.

1-3 Contents of the Survey

Based upon the terms of references as well as discussions with JICA, the contents of this survey are indicated and summarized as follows:

1. Collection and analysis of the following information on the power sector in Kyrgyzstan
   ① Organizational structure in the power sector
   ② Basic information on overall power sector such as policies, legal systems, demand forecasts, demand & supply plans, power system development plans, rural electrification plans, losses, tariffs, supply costs, etc.
   ③ Upgrading and expanding plans on transmission and distribution facilities
   ④ Identification of issues in institutions, development plan, policies and budgets concerning small hydropower development
   ⑤ Priorities of small hydropower developments in overall power policies
   ⑥ Donors' assistance activities related to small hydropower developments
   ⑦ Items to be considered on environmental and social considerations for small hydropower developments, inclusive of legal systems as well as actual examples
   ⑧ Background of the past small hydropower developments, current conditions and actual operations of existing small hydropower plants, and the government plans for future developments of small hydropower plants
   ⑨ Possibilities of hydropower developments by the private sector participation, promoted by some donors

2. Collection and analysis of the following information for a small hydropower development in Chui Oblast
   ① Information of implementation structure for small hydropower entities
      A) Organization framework
      B) Technical capabilities for operation and maintenance
      C) Financial status
      D) Implementation structure for small hydropower developments
   ② Information of small hydropower potential sites
      A) Outline of sites (geographical, economical and socio-analytical aspects)
      B) Hydrological, topographical and geological information
      C) Areas to be benefitted and beneficiaries
      D) Water-use (irrigation, domestic use, etc.)
      E) Current power supply situation

F) Power demand forecast
G) Contributions of small hydropower developments to policies and development plans for overall power sector
H) Transmission and distribution lines and traffic condition/accessibility
I) Electricity tariff system
J) Operation and maintenance system for small hydropower plants
K) Environmental and social aspects

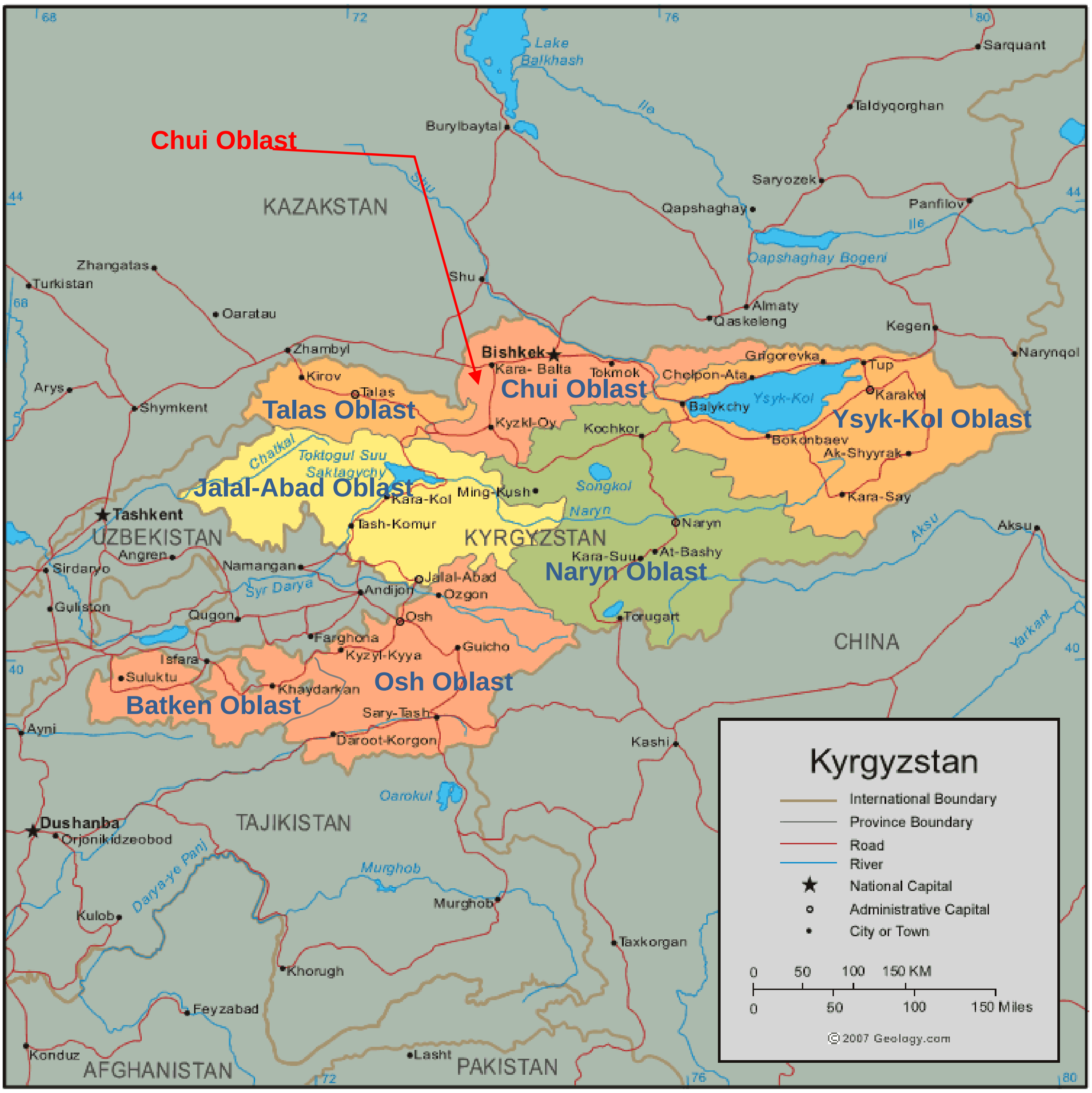

Figure 1-3-1 Location Map of Chui Oblast, Kyrgyzstan

3. Identification of issues in the power sector of Kyrgyzstan and consideration of countermeasures thereto
   ① Identification of issues in the power sector of Kyrgyzstan and consideration of countermeasures thereto
   ② Preparation of prioritization procedure and its criteria for selecting small hydropower potential sites
   ③ Arrangement of information related to possible potential sites based on the prioritization procedure and its criteria
   ④ Review of generation plan on candidate small hydropower plants
   ⑤ Identification of further survey items to be required for implementation of future grant aid projects

1-4 Background of the Survey

There are abundant of hydropower potentials in Kyrgyzstan, but not so much of those potentials in the neighboring countries of Central Asian countries.
During the former Soviet Union, the largest reservoir, i.e., Toktogul reservoir, in the Central Asia had been developed for irrigation. Currently, the water of Toktogul reservoir in Kyrgyzstan is used for supplying irrigation water to the downstream countries such as Kazakhstan and Uzbekistan. The reservoir water can be also utilized for power generation of the large scale reservoir type hydropower plants, i.e., Toktogul hydropower plant as well as downstream hydropower stations thereof. It is herein noted that water controls of the reservoir, not for power generations but for irrigation water, had been prioritized for the downstream countries. Therefore, surplus generation in summer and lack of generation in winter of the Toktogul hydropower plant due to irrigation water management has been pointed out as a serious regional issue.
Upon the circumstances mentioned above, during the non-irrigation period in which power generation is insufficient due to small water usage for the downstream irrigation, barter transactions for the downstream countries to provide thermal power fuels and power exports to Kyrgyzstan had been made. However, after the collapse of the former Soviet Union, each country has been obviously interested in the independence of the country. Accordingly, the abovementioned complex transactions had been dysfunctional and, nowadays in Kyrgyzstan, reliance is increased more on the domestic hydroelectric power utilizations from abundant of water resources.

Power demand and supply of Kyrgyzstan is tight especially in winter for high heating demand. The main power generation facilities in Kyrgyzstan are hydropower stations such as Toktogul hydropower station as well as the downstream and upstream stations thereof, located on the Naryn River Syr Darya flow, in which 90% of the total power generation capacity of the country is covered. However, since river flow is reduced in winter and also large-scale reservoir is regulated by agreement with the downstream countries for the irrigation use, power supply of winter by hydropower generation is reduced in Kyrgyzstan. On the other hand, current available outputs of the existing thermal power plants have not been able to compensate for the decrease in hydropower in winter because of the aging thermal power facilities and insufficient fuel procurements. Therefore, in the winter, there are power shortages continuously in the country.

Currently, the utilization of water resources has been made at approximately 10% of whole water resources and therefore it can be understood that hydropower potentials are still high in Kyrgyzstan. However, since the long period of time and significant investment of capital cost are required for development of large-scale hydropower plants, it is not easy to mitigate the balance of power demand and supply immediately.

On the other hand, in Kyrgyzstan, in the 1950's to 1960's Soviet eras, many small-scale hydropower plants were built. After realization of some of the large-scale hydropower projects such as Toktogul hydropower plant in the 1970's, many small-scale hydropower plants were stopped and abolished.

Within this context, enhancement of the power generation capacity of large-scale hydropower is difficult and therefore small hydropower developments, for which period of time is relatively short to completion, have been emphasized in recent years for the purpose of immediate realization to mitigate tight situation of power demand and supply in Kyrgyzstan.

1-5 Team and Schedule of the Survey

1-5-1 Member List of the Survey Team

The following table shows the member list of the survey team.

Name	Position	Organization
Hitoshi FURUKOSHI	Team Leader/ Small Hydropower Development Plan	Tokyo Electric Power Services Co., Ltd.
Seiichi SUZUKI	Sub-Team Leader/ Small Hydropower Development Plan	Tokyo Electric Power Services Co., Ltd.
Chiyuki JOZAKI	Small Hydropower Engineering (Mechanical Equipment/ Plant Operation)	Tokyo Electric Power Services Co., Ltd.
Masahiko NAGAI	Small Hydropower Engineering (Civil, Topography and Hydrology)	Tokyo Electric Power Services Co., Ltd.
Seiji OKANO	Environmental and Social Considerations	CTI Engineering International Co., Ltd.
Yasuharu SATO	Transmission and Distribution Plan	CTI Engineering International Co., Ltd.

1-5-2 Survey Schedule

The followings show the first survey schedule (in February 6-22, 2013) and the second survey schedule (in April 1-26, 2013).

The First Survey Schedule

Date			Hitoshi FURUKOSHI (Mr.)	Seiichi SUZUKI (Mr.)	Chiyuki JOZAKI (Mr.)	Masahiko NAGAI (Mr.)	Seiji OKANO (Mr.)	Yasuharu SATO (Mr.)
1	6-Feb	Wed	Move from Narita to Bishkek					
2	7-Feb	Thu	Bishkek (Meeting with JICA Office, Embassy of Japan and MEI)					
3	8-Feb	Fri	Bishkek (Meeting with MEI and KSTC)					
4	9-Feb	Sat	Bishkek (Meeting with MEI)					
5	10-Feb	Sun	Bishkek (Data Arrangement)					
6	11-Feb	Mon	Site Survey (Chakan GES)					
7	12-Feb	Tue	Bishkek (Meeting with JSC EPP and JSC NEGK)					
8	13-Feb	Wed	Site Survey (Kegeti)					
9	14-Feb	Thu	Departure from Bishkek			Bishkek (Meeting with UNDP and GEF)		Bishkek (Meeting with UNDP and JSC Severelectro)
10	15-Feb	Fri	Arrive at Narita			Bishkek (Meeting with KSTC and Hydromet)		
11	16-Feb	Sat				Bishkek (Data Arrangement)		
12	17-Feb	Sun				Bishkek (Data Arrangement)		
13	18-Feb	Mon				Site Survey (Sokuluk-1, Sokuluk-2 and Alamedin)		
14	19-Feb	Tue				Site Survey (Issyk-Ata)		
15	20-Feb	Wed				Bishkek (Meeting with UNDP, SAEPF and JICA Office)		Bishkek (Meeting with JSC Severelectro)
16	21-Feb	Thu				Departure from Bishkek		
17	22-Feb	Fri				Arrive at Narita		
Total Days			10	10	10	17	17	17

The Second Survey Schedule

<table>
<tr><th colspan="3"></th><th>Hitoshi FURUKOSHI (Mr.)</th><th>Seiichi SUZUKI (Mr.)</th><th>Chiyuki JOZAKI (Mr.)</th><th>Masahiko NAGAI (Mr.)</th><th>Seiji OKANO (Mr.)</th><th>Yasuharu SATO (Mr.)</th></tr>
<tr><td>1</td><td>1-Apr</td><td>Mon</td><td></td><td colspan="3">Move from Narita to Bishkek</td><td></td><td></td></tr>
<tr><td>2</td><td>2-Apr</td><td>Tue</td><td></td><td colspan="3">Bishkek (Meeting with KSTC, MEI and Academy)</td><td></td><td></td></tr>
<tr><td>3</td><td>3-Apr</td><td>Wed</td><td></td><td colspan="3">Bishkek (Meeting with KSTC, MEI and JICA Office)</td><td></td><td></td></tr>
<tr><td>4</td><td>4-Apr</td><td>Thu</td><td></td><td>Site Survey (Djardy-Kainda)</td><td>Bishkek (with JSC Chakan GES)</td><td>Site Survey (Djardy-Kainda)</td><td></td><td></td></tr>
<tr><td>5</td><td>5-Apr</td><td>Fri</td><td></td><td colspan="3">Bishkek (Meeting with Directorate, Inkraft and JSC EPP)</td><td></td><td></td></tr>
<tr><td>6</td><td>6-Apr</td><td>Sat</td><td></td><td colspan="3">Bishkek (Data Arrangement)</td><td></td><td></td></tr>
<tr><td>7</td><td>7-Apr</td><td>Sun</td><td></td><td colspan="3">Bishkek (Data Arrangement)</td><td></td><td></td></tr>
<tr><td>8</td><td>8-Apr</td><td>Mon</td><td></td><td>Bishkek (Meeting with MEI & JSC EPP)</td><td colspan="2">Bishkek (Meeting with KSTC)</td><td>Move from Narita to Bishkek</td><td></td></tr>
<tr><td>9</td><td>9-Apr</td><td>Tue</td><td></td><td>Bishkek (Attended at Donor meeting)</td><td>Bishkek (Meeting with KSTC)</td><td>Bishkek (Attended at Donor meeting)</td><td>Bishkek (Meeting with KSTC)</td><td></td></tr>
<tr><td>10</td><td>10-Apr</td><td>Wed</td><td>Move from Narita to Bishkek</td><td colspan="2">Bishkek (Meeting with MEI and DFR)</td><td colspan="2">Site Survey (Shamsi)</td><td>Move from Narita to Bishkek</td></tr>
<tr><td>11</td><td>11-Apr</td><td>Thu</td><td colspan="2">Bishkek (Meeting with MEI)</td><td>Departure from Bishkek</td><td colspan="2">Bishkek (Data Arrangement)</td><td>Bishkek (Meeting with JSC Serverelectro)</td></tr>
<tr><td>12</td><td>12-Apr</td><td>Fri</td><td colspan="2">Bishkek (Meeting with MEI)</td><td>Arrive at Narita</td><td>Site Survey (Kegeti)</td><td>Bishkek (Data Arrangement)</td><td>Bishkek (Meeting with JSC NEGK)</td></tr>
<tr><td>13</td><td>13-Apr</td><td>Sat</td><td colspan="2">Site Survey (Sokuluk)</td><td></td><td colspan="2">Site Survey (Sokuluk)</td><td>Bishkek (Meeting with MEI) Site Survey (Sokuluk)</td></tr>
<tr><td>14</td><td>14-Apr</td><td>Sun</td><td colspan="2">Bishkek (Data Arrangement)</td><td></td><td colspan="3">Bishkek (Data Arrangement)</td></tr>
<tr><td>15</td><td>15-Apr</td><td>Mon</td><td colspan="2">Bishkek (Data Arrangement)</td><td></td><td colspan="3">Bishkek (Data Arrangement)</td></tr>
<tr><td>16</td><td>16-Apr</td><td>Tue</td><td colspan="2">Bishkek (Data Arrangement)</td><td></td><td colspan="2">Bishkek (Meeting with Water Resource Agency)</td><td>Bishkek (Data Arrangement)</td></tr>
<tr><td>17</td><td>17-Apr</td><td>Wed</td><td colspan="2">Site Survey (Chon-Kemin)</td><td></td><td>Site Survey (Chon-Kemin)</td><td>Bishkek (Meeting with SRS and SAEPF)</td><td>Site Survey (Chon-Kemin)</td></tr>
<tr><td>18</td><td>18-Apr</td><td>Thu</td><td colspan="2">Bishkek (Meeting with MEI)</td><td></td><td colspan="3">Bishkek (Data Arrangement)</td></tr>
<tr><td>19</td><td>19-Apr</td><td>Fri</td><td colspan="2">Bishkek (Meeting with USAID & Attended at Donor meeting)</td><td></td><td>Bishkek (with JSC Chakan GES)</td><td>Bishkek (Meeting with SIETS)</td><td>Bishkek (Meeting with USAID, DPCC WG and MEI)</td></tr>
<tr><td>20</td><td>20-Apr</td><td>Sat</td><td colspan="2">Bishkek (Meeting with MEI)</td><td></td><td>Site Survey (Ak Suu)</td><td colspan="2">Site Survey (Djardy-Kainda)</td></tr>
<tr><td>21</td><td>21-Apr</td><td>Sun</td><td colspan="2">Site Survey (Kegeti)</td><td></td><td colspan="3">Site Survey (Kegeti)</td></tr>
<tr><td>22</td><td>22-Apr</td><td>Mon</td><td>Bishkek (Meeting with JICA and EoJ)</td><td>Bishkek (Meeting with JSC Chakan GES and EoJ)</td><td></td><td>Bishkek (Meeting with JSC Chakan GES and EoJ)</td><td colspan="2">Bishkek (Meeting with JICA and Embassy of Japan)</td></tr>
<tr><td>23</td><td>23-Apr</td><td>Tue</td><td>Departure from Bishkek</td><td>Bishkek (Meeting with ADB and WB)</td><td></td><td colspan="2">Departure from Bishkek</td><td>Bishkek (Meeting with JSC NEGK and ADB)</td></tr>
<tr><td>24</td><td>24-Apr</td><td>Wed</td><td>Arrive at Narita</td><td>Bishkek (Report to MEI)</td><td></td><td colspan="2">Arrive at Narita</td><td>Bishkek (Report to MEI)</td></tr>
<tr><td>25</td><td>25-Apr</td><td>Thu</td><td></td><td>Departure from Bishkek</td><td></td><td colspan="2"></td><td>Departure from Bishkek</td></tr>
<tr><td>26</td><td>26-Apr</td><td>Fri</td><td></td><td>Arrive at Narita</td><td></td><td colspan="2"></td><td>Arrive at Narita</td></tr>
<tr><td colspan="3">Total Days</td><td>15</td><td>26</td><td>12</td><td>24</td><td>17</td><td>17</td></tr>
</table>

Chapter 2 Current Status of the Power Sector

2-1 Organization of the Power Sector

2-1-1 Organizational Framework

The power sector of Kyrgyzstan is governed by two organizations, i.e., the Ministry of Energy and Industry (hereinafter "MEI") and the State Property Fund (hereinafter "SPF") under the government. Based upon the Energy Law (1996) and the Electricity Law (1997)[1], vertical integrated power entity, Kyrgyzenergo, was spun off into the separate companies. As the result, power generation, transmission and distribution companies were organized in 2001 as state owned business units for the purpose of promotion of private participation to the power sector.
The current organization structure of the power sector is shown in Figure 2-1-1.

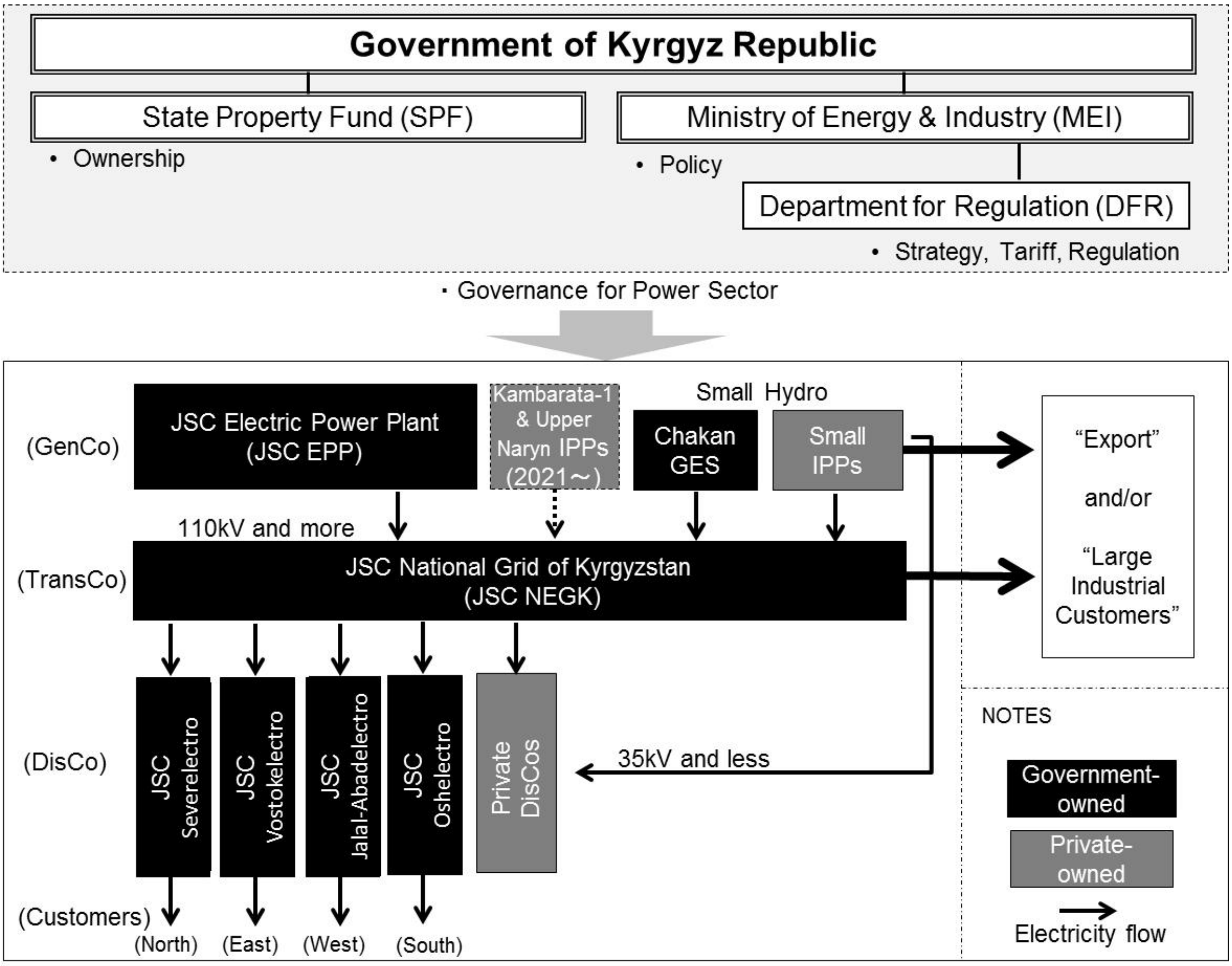

Figure 2-1-1 Power Sector Organization Chart

MEI is in charge of the policy-making of the power sector.
The Department for Regulation (hereinafter "DFR"), organized under MEI, is the agency to formulate the power sector development strategy of the country. DFR is also the agency to determine electricity tariffs to consumers and also fiscal year plans about unit prices paid to the generation, transmission and distribution companies. In addition, the Performance Indicator Agreements are signed every year between DFR and the respective generation, transmission and distribution

[1] Law on Energy number 56, October 1996, and Law on the electricity number 8, January 1997

companies for efficiency increase and loss reduction, in which DFR has a role of supervising a target and a result thereof. Furthermore, DFR is also in charge of licensing the right to operations, developments, etc. for activities in the power sector.

SPF is an owner of the state-owned generation, transmission and distribution companies as shown below, and has a role of monitoring management of those companies.

- Two (2) of generation companies
  - Joint Stock Company “Electric Power Plants”/JSC EPP
  - JSC Chakan GES (Only for Small Hydropower Plants)
- One (1) of transmission Company
  - Joint Stock Company “National Grid of Kyrgyzstan”/JSC “NEGK”
- Four (4) of distribution companies
  - JSC Severelectro (For the northern region)
  - JSC Vostokelectro (For the eastern region)
  - JSC Jalal-Abadelectro (For the western region)
  - JSC Oshelectro (For the southern region)

SPF, as a stockholder, has share of 80% of the generation, transmission and distribution companies after the spin-out in 2001. When profits come out in the companies, SPF collects 30% of profits therefrom as a dividend. The rates of overall shareholdings are 80% of SPF, 13% of social fund and 7% of a private sector, and therefore it can be observed that the companies are still substantially state-owned enterprises.
SPF had tried to privatize JSC Chakan GES in 2005 and JSC Vostokelectro and JSC Severelectro in 2009. However, since there was an uncertain money movement, the current president has re-nationalized the abovementioned companies in 2010 by intention.

2-1-2 Technical Capability for Operation and Maintenance

JICA Study Team referred to the recent USAID reports[2,3,4,5] on the management diagnostic of JSC EPP, JSC NEGK, and 4 distribution companies as one of the typical study results on the operation and maintenance capacities of the companies due to difficulty in conducting detailed fact findings during the mission.

(1) JSC EPP
The principal issues on the operation and maintenance of the generation facilities for JSC EPP are as follows:

- Upgrades continue to be deferred. Less attention is focused on critical parts because there is no money to replace them.
- The engineers are doing their best with a small budget to continually fix obsolete parts. They suffer from a lack of key spare parts.
- Significant parts are not being replaced and systematic replacement /upgrade of the large units is not scheduled and financed. This high priority maintenance and replacement should be part of the Company’s strategic plan and its implementation must be funded in order to avoid the problem of higher costs later. Continuing to operate this way increases the risk of emergency outages.

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2 Management Diagnostic of JSC Power Plant on Phase 1: Preliminary Findings and Recommendation, March 31, 2011, USAID
3 JSC Electric Power Plants Management Diagnostic Recommendations Implementation Plan PHASE 2, June 2011, USAID
4 Management Diagnostic of the National Electricity System of Kyrgyzstan (JSC “NESK”), Report on Phase 1: Preliminary Findings and Recommendations, March 31, 2011, USAID
5 Management Diagnostic of the Electricity Distribution Companies of the Kyrgyz Republic, Report on Phase 1: Preliminary Findings & Recommendations, March 31, 2011, USAID

- JSC EPP's organization is still using former Soviet Union "norms" for planning maintenance. Staff training in up-to-date HPP maintenance practices would be necessary. There was apparently a government decree that "norms" older than 1991 can no longer be used. However, the "book" of norms has not been issued yet to replace it.
- Effective management of a generating company depends on instantaneous information. The HPP cascades communicate with dispatch by phone with very limited communications. It should be a strategic objective that real time data become available to the JSC EPP's dispatch center and also to headquarters.

For the abovementioned issues, USAID made the following recommendations:

- Introducing prudent management approaches to planning and funding the maintenance needed to preserve the long term value and productivity of the existing hydropower plants
- Introducing proper business planning focused on maintenance and investment in repair and replacement to prevent breakdowns and outages rather than simply restoring them after the fact
- Funding and implementing as a matter of urgent priority a risk-based maintenance and replacement plan for hydropower plants
- Installing real time information systems so that management can monitor plant performance and activity in the field, and increase efficiency and minimize costs to the system meeting loads and exporting power
- Encouraging and training key engineers and managers to seek out, understand and apply modern technology and methods
- Exposing more key operators and planners to current hydroelectric practice and equipment

The observations point out that JSC EPP is facing the risk that serious equipment accidents may occur in the near future because JSC EPP has done the operation and maintenance inefficiently based on the obsolete method. In addition, JSC EPP cannot install the modern operation monitoring information system or replace the aged main equipment since JSC EPP has not been able to secure sufficient funds for conducting appropriate operation and maintenance.

(2) JSC NEGK

The principal issues on the operation and maintenance of the transmission facilities for JSC NEGK are as follows:

- The Central Dispatch Service (hereinafter referred to as CDS) of Kyrgyzstan has limitation of acquiring real-time data on the system operation. Due to this situation, CDS still relies on telephoned reports regarding such important items as changes in the condition of circuit breakers, overloading of transmission lines and substation transformers, generators disconnecting from the grid.
- Regarding the substation infrastructures, the equipment of which technology used was completely outdated was installed in the Soviet era. Therefore, the equipment is fully dilapidated and overdue for replacement.
- The top management of the company relies on the set of standard procedures established during the Soviet era as a norm, rather than on the planning, maintenance, rehabilitation, and system upgrade based on the knowledge of skilled engineers who understand the details of the actual equipment conditions.
- Contrary to the international practice, which enables preventive maintenance by using diagnostic equipment to decide precise needs for maintenance, the present practice of JSC NEGK is quite inefficient in that for both the light-loaded equipment and that with a heavy duty cycle, the same frequency of maintenance are continued to be scheduled.
- Lack of the ability to properly handle the equipment with modern technologies
- The budget of capital investment and rehabilitation is not sufficient considering the volume of the facilities. Therefore, JSC NEGK cannot conduct proper rehabilitation and replacement of the aging equipment.

For the abovementioned issues, USAID made the following recommendations:

- Detailed assessment of the technical conditions of critical facilities
- Identification of the implications of the current practice of continuing postponement of urgently needed rehabilitation and replacement of equipment
- Proposal of the most cost-efficient rehabilitation and replacement plan and budget
- Seeking for approval of the proposed plan and budget by the board of directors of the company, Regulators, and the Ministry of Energy and Industry

The observations point out that JSC NEGK has conducted inefficient equipment maintenance based on the obsolete operation and maintenance practices. Regarding the equipment rehabilitation and replacement projects, installation of equipment with modern and sophisticated technologies has been implemented through donors' assistance; however, the ability to properly maintain the newly installed equipment is insufficient, thus having difficulty in conducting proper maintenance of the facilities.

(3) Distribution Companies

The principal issues on the operation and maintenance of the distribution facilities for distribution companies are as follows:

- Due to lack of resources, the distribution facilities are not maintained in appropriate condition.
- The maintenance planning to be made in the beginning of each year is dealt, in reality, as a wish list, and the distribution companies are forced to change the priorities of the items in the plan due to reduction in the budget during the period, etc.
- The maintenance works are planned not from the viewpoint of proper equipment maintenance but by intervention of politicians and government representatives.
- The special technology and equipment for facility maintenance is obsolete and dilapidated.
- The distribution network is not mapped accurately, thus making it difficult for the staff to identify distribution losses and system breakdown.

For the abovementioned issues, USAID made the following recommendations:

- It is necessary for the distribution companies to improve the maintenance planning process to make it more realistic.
- Putting higher priority for the maintenance of the special distribution system
- Putting higher priority for the documentation process
- Development of the training for using special equipment with modern and sophisticated technologies, and assignment of the equipment for maintenance
- Insulation of the priority setting in the business planning from undue external influence as much as possible.
- Along with installation of new meters, proper network mapping should be implemented at the same time. Detailed survey should be conducted to develop GIS (Geographical Information System) when funding becomes available.

The distribution companies identified that less-accurate old type meters cause the loss, thus proceeding replacement with the new meters. Besides, they recognize the necessity of rehabilitation/replacement of the aging equipment although it has been difficult for them to implement the rehabilitation/replacement on schedule due to lack of funding and undue intervention of authorities. From these points, each distribution companies have high ability to carry out operation and maintenance of the facilities. It would be possible to improve the situation under the proper assistance that follows the recommendations.

2-1-3 Financial Condition

The government believes that the public's understanding of the tariffs increase is not obtained and the government is considering carefully the extent and timing of the tariffs increase. As the result of this, power generation / transmission / distribution companies are placed in the severe financial condition (as shown in Table 2-1-1). The current tariffs cover only minimum labor costs, etc. and do not cover appropriate operating costs and benefits of power generation, transmission and distribution companies. In addition, the tariffs don't reflect adequately the cost of the expenditures urgently needed to rehabilitate worn-out equipment and expand the power system in order to meet the growing power demands.

Table 2-1-1 Energy Sector Reported Profit and (Loss)

Unit: thousand Som

	2009	2010
JSC EPP	(1,951,054)	(531,915)
JSC NEGK	(166,373)	104,555
JSC Severelectro	(61,024)	9,720
JSC Vostokelectro	(3,281)	(63,845)
JSC Oshelectro	25,980	(92,257)
JSC Jalal-Abadelectro	(19,002)	1,323
Total	**(2,174,754)**	**(572,419)**

(Source: USAID)

USAID points out that there has been no reliability in the current power system already[6], and USAID encourages a shift of the policy to the government. As shown in Table 2-1-2, USAID suggests three scenarios regarding the prime cost of the electricity supply service according to the level of the service quality[7].

Table 2-1-2 Estimated Prime Cost of Electricity

	Scenario 1	Scenario 2	Scenario 3
Level of Service Quality	Continuing unreliable deteriorating service	Restoring reliability of the existing power system	Eliminating winter power deficits and ensuring reliability of an electric power supply throughout the year and the Republic
Prime Cost of Electricity	0.99 Som/kWh	1.65 Som/kWh	2.03 Som/kWh
Revenue Requirement	190 mil. USD	326 mil. USD	415 mil. USD
Management Level	High Risk Management	Prudent Management	Responsible Management

(Source: USAID)

Cost component of power generation / transmission / distribution companies is shown in Table 2-1-3. When the Scenario 3, the most reliable one, is selected, tariffs must be raised to the three times the current level.

6 The Energy Sector's Crisis: Our "Dangerous Opportunity", USAID
7 REVIEW OF THE PRIME COST OF ELECTRICITY, March 3, 2011, USAID

Table 2-1-3 Estimated Prime Cost of Electricity (Cost Component: 2010)

Unit: Som/kWh

	Current Tariff	Scenario 1	Scenario 2	Scenario 3
Generation	0.21	0.41	0.65	0.87
Transmission	0.13	0.15	0.25	0.41
Distribution	0.36	0.43	0.75	0.75
Total	**0.70**	**0.99**	**1.65**	**2.03**

(Source: USAID)

2-2 Legal System

After the Soviet era, the main legal systems related to the power sector of Kyrgyzstan were established in 1996 as the "Energy Law" and also established in 1997 and revised in 2012 as the "Electricity Law".
Based on the abovementioned laws, vertical integrated power entity, Kyrgyzenergo, was spun off into the separate companies. As the result, power generation, transmission and distribution companies were organized in 2001 as state-owned business units for the purpose of promotion of private participation to the power sector.
An overview of the Energy Law (1996) and the Electricity Law (1997) are summarized as follows;

In the Energy Law (1996), the license which the government defines is needed for the development and utilization of all the primary energy sources containing the water resources of the country. The government is in charge of development of the market where the private sector can enter to instead of the monopoly organization owned by the government.

In the Electricity Law (1997), licenses for carrying out power generation, transmission and distribution businesses inclusive of retails are explained in details with formation of the market where the private sector can enter in the power sector as described in the Energy Law (1996).
Key points, which should be herein mentioned particularly, are described below.

1. Results of an investigation shall be reported to the government instead that a licensing is unnecessary to a preliminary survey of hydropower developments as relief measures,
2. The licenses regarding the renewable energy are given not by the government but by MEI,
3. The licenses to the own-use generation of electricity below 1,000 kW are not required.
4. Distribution companies are licensed on a regional basis, and shall distribute power with responsibility for remote areas in the region.
5. The Transmission Company, JSC NEGK, shall be conducted under the responsibility of National System Operation.
6. The licenses are required for import and export of electric powers, and
7. The electricity tariffs shall be more than a full cost recovery level of operation and maintenance by the power generation, transmission and distribution companies.

Based on the legal system described above, the entry status of the private sector to the power sector can be written as;

- Two (2) companies in the field of power generation
  - "Arc" LLC small hydroelectric power producers (Issyk-Ata small hydro)
  - "Kalinin HPP" LLC (Karinin small hydro)
- Four (4) companies in the field of distribution
  - "TransElectro" CJSC
  - "Aksel" LLC
  - "EnergoTrade" LLC
  - "Energotechservice" LLC

It is herein noted that participations of the private sector to the power sector is not sufficient.
Currently, the large hydropower projects, i.e., Kambarata-1(1,900MW) and Upper Naryn cascade (191MW), are planned under participation of the private sector. Those projects have been positioned as IPP (Independent Power Producer) projects, and are expected to commission in 2021. The developers of the projects are Russian (InteRAO and RusHydro) with share of 50%, which is expected as a major achievement of the legal system development.

2-3 Electricity Tariff System

2-3-1 Tariff System

The Electricity Law, established in 1997 and revised in 2012, indicated that DFR under MEI shall determine the electricity tariffs in accordance with the following.

- Tariffs shall be the full cost recovery levels reflecting of the overall operating costs related to power generation, transmission, distribution, capital investment, internal rate of return and the like. The tariffs should reflect the cost of the power supply services that varies in accordance with the quality and type of the power supply service if the consumer can choose.
- When changing the tariffs, impacts upon consumers and suppliers shall be considered so as not to cause the rapid economic difficulties.
- Discriminatory treatment to consumers shall not be allowed with respect to setting the tariffs. Consumers should receive the power supply services under the same conditions from the distribution companies at the same rates of electricity. In addition, there should be no subsidy to another group from consumer groups.

2-3-2 Recent Changes of Electricity Tariffs

Electricity tariffs to consumers have been changed to date as shown in Table 2-3-1.

Table 2-3-1 Transition of the Electricity Tariffs

Unit: Som/kWh

Categories	a) Jul. 1, 2008	b) Jan. 1, 2010	c) Apr. 1, 2010	=c) / a)
1. Residential(*)	0.70	1.327	0.70	100.0%
2. Pump Stations(*)	0.68	1.327	0.70	102.9%
3. Industry(**)	0.96	1.327	1.327	138.2%
4. Agriculture(**)	0.96	1.327	1.327	138.2%
5. Budget(**)	1.00	1.327	1.327	132.7%
6. Others(**)	1.02	1.327	1.327	130.1%

(*) Tax exemption, (**) Before taxes (Source: USAID)

The current electricity tariff system was enacted in April 2010.
Currently, the electric power is sold at the rate of 0.70Som/kWh (= 1.5US cent/kWh) for items 1 and 2 in Table 2-3-1, for which tax exemptions have been taken and the amount of electricity sales are approximately 70% of the total. For the remaining 30% of sales for items 3 to 6 in Table 2-3-1, the rate is 1.327Som/kWh (= 2.6US cent/kWh) without taxes and 1.500Som/kWh (= 2.9US cent/kWh) with taxes.
The electricity rates were increased for the abovementioned items 1-2 in January 2010, but the hike has been canceled in April 2010 which was just three months later. The electricity hike in January 2010 became a cause of the former President’s downfall due to occurrence of people riot.

2-3-3 Flows of “Money” and “Electricity”

In Kyrgyzstan, for the purpose of ensuring the account transparency, an escrow accounting system is introduced in 2010, which makes all the money flows through the escrow bank as third party as shown in Figure 2-3-1.
Regarding the payments to the generation, transmission and distribution companies, there is a rule that monthly unit rates for electricity-sales-to-utilities shall be determined by DFR based on a given fiscal

year planning of income and expenditure of the respective companies.
It is herein noted that the escrow account system has not been applied for the power export since 2012, and each company is allowed to conclude a Power Purchase Agreement (PPA) with the third country, such as 3.2US cent/kWh to Uzbekistan, 2.8US cent/kWh to Kazakhstan, 5.6US cent/kWh to China and the like. However, the use of income by the export is regulated. The generation company shall use the abovementioned income from power exports only for fuel procurements. Also, the transmission company shall expense it to repair and maintenance of existing facilities.
In addition, the escrow account system has not been applied for JSC Chakan GES, which can make a direct contract with the regional distribution companies.

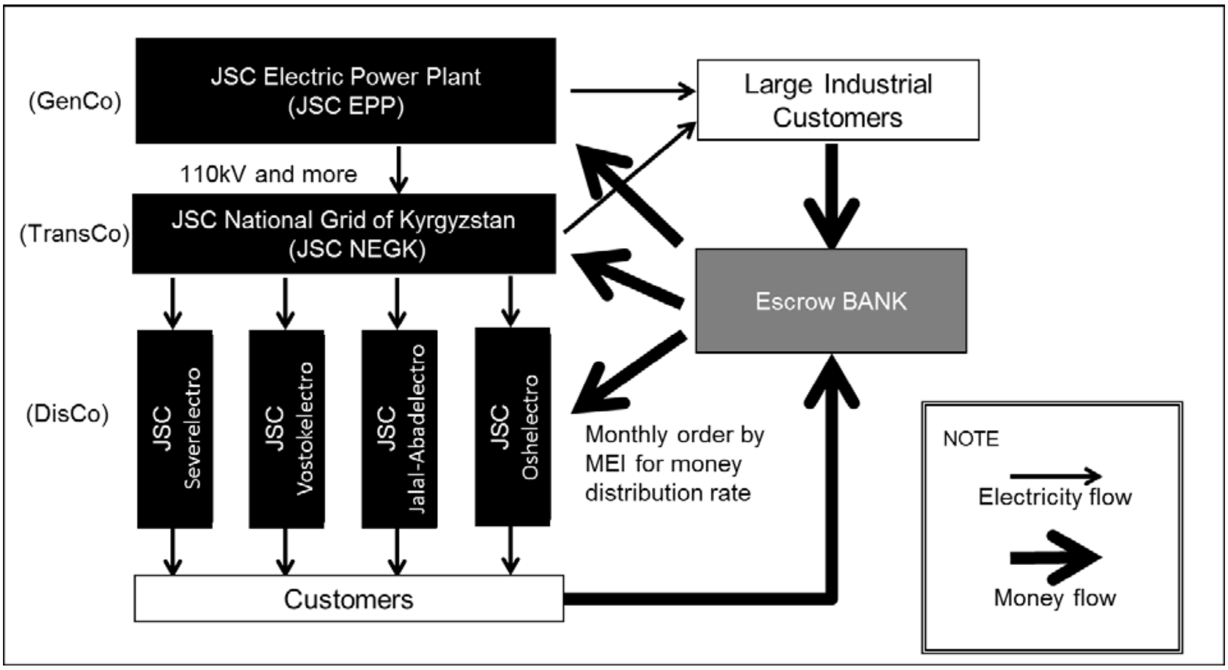


Figure 2-3-1 Flows of "Electricity" and "Money" in the Power Sector

2-3-4 Present Condition and Future plans of Electricity Tariff level

Current level of tariffs does not reach full cost recovery level to cover a reasonable profit and all necessitated expenditures of power generation, transmission and distribution companies.
According to the estimates of DFR, weighted average of tariffs in 2013 is calculated to be 0.879Som/kWh, which cover only minimum labor costs, etc. and does not cover appropriate operating costs of power generation, transmission and distribution companies. In addition, DFR estimated that the weighted average of the tariffs of full cost-recovery level should be 1.243Som/kWh, i.e., approximately 140% of current average tariff 0.879Som/kWh. It is therefore indicated that 40% tariff increase should be required immediately.
Under the circumstances mentioned above, DFR has a plan for carrying out tariff increase of twice a year from 2014, and it would be increased up to the full cost-recovery level within 5 years.

2-4 Situations of Power Demand and Supply

2-4-1 Overview of Existing Facilities

1. Power Generation Facilities

Overviews of existing power generation facilities are shown in Table 2-4-1.

Table 2-4-1 Overview of Existing Power Plants

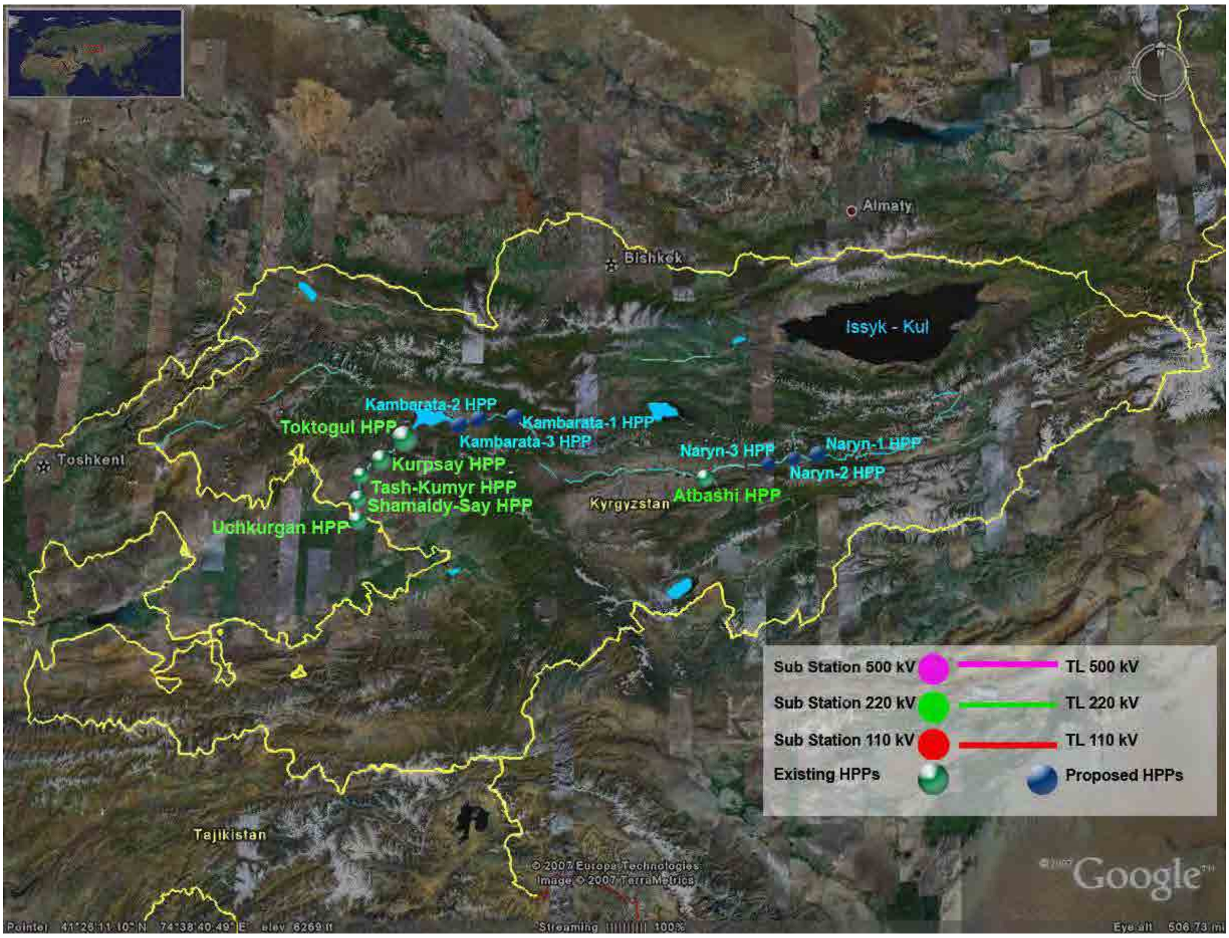
Name	Operation year	Installed capacity (MW)	Available capacity (MW)
<Hydropower>			
1. Toktogul hydropower plant	1975	1200	1200
2. Kurpsai hydropower plant	1981	800	800
3. Tash-Kumyr hydropower plant	1985	450	450
4. Shamaldy-Sai hydropower plant	1994	240	240
5. Uchkurgan hydropower plant	1961	180	175
6. At-Bashi hydropower plant	1970	40	38
7. Kambarata hydropower plant-2 (#1)	2010	120	60(*)
8. Small hydropower plants-12 units	1940-1960	40	24.4
<Thermal Power>			
9. Heating power plant of Bishkek city	1961	666	250
10. Heating power plant of Osh city	1966	50	0
Total		**3786**	**3238**

(*) Available capacity 60MW of Kambarata-2 is to be 120MW after completion of Kambarata-1.

(Source: MEI)

More than 80% of the installed capacity and also more than 90% of the available capacity has been shared by hydropower across the country. The available capacity, which can be actually generated at present, is 3,238 MW, i.e., 85% of the total installed capacity 3,786 MW. There is 15% discrepancy between installed and available capacities, and that is mainly caused by decreasing outputs due to the aging of thermal power plants in the items 9 and 10 of Table 2-4-1 in particular.

All of hydropower plants of items 1 to 7 in Table 2-4-1 are located in the Naryn River. The items 1 to 5, i.e., Toktogul, Kurpsai, Tash-Kumyr, Shamaldy-Sai, Uchkurgan hydropower plants, are available for peak operations because those are located along downstream of Toktogul regulating reservoir. At-Bashi hydropower plant, mentioned in the item 6 in Table 2-4-1, is run-off-river type and therefore the available capacity is reduced in winter depending upon a decrease of the natural river flow discharge. Kambarata-2 hydropower plant of the item 7 is currently operated as a run-off-river type however is to be the regulating reservoir type after the completion of Kambarata-1 hydropower plant (1,900MW, 2021) in the upstream. Small hydropower plants of the item 8 has totally 12units and 40MW of total installed capacity, of which JSC Chakan GES owns 9 units and 38.5MW in Chui Oblast.



(Source: IMF – Kyrgyzstan: Power Generation & Transmission, US Embassy Bishkek)

Figure 2-4-1 Location Map of Power Plants and Transmission Systems

2. Transmission Facilities[8]

JSC NEGK owns, operates, maintains, and dispatches the transmission and substation facilities with the voltage from 110kV to 500kV. The company wholesales the power generated at all the hydropower stations in Kyrgyz to 4 distribution companies and 68 directly connected large customers, and imports/exports electricity with Uzbekistan and Kazakhstan through several international interconnection transmission lines with the voltage range from 35kV to 500kV. The transmission and substation facilities as of 2012 are summarized in Table 2-4-2. The voltage classes of the transmission lines are 500kV, 220kV, and 110kV, and the total length is 6,807km. The number of substations is 190 units, and the total capacity is 9,326MVA. The 500kV transmission system consists of 2 lines; one line runs inside Kyrgyz and transmits bulk power generated at the hydropower stations in the south to the load center, including Bishkek city, in the north, and the other line is the international interconnection line, which is augmented by 220kV and 110kV transmission lines for regional supply, from the same power sources to the north of the country via neighboring Uzbekistan and Kazakhstan.

[8] Management Diagnostic of the National Electricity System of Kyrgyzstan (JSC "NESK"), Report on Phase 1: Preliminary Findings and Recommendations, March 31st, 2011, USAID

Table 2-4-2 Transmission and Substation Facilities in Kyrgyz (As of 2012)

Voltage	Transmission Lines (km)	Substations (units)	Substations (MVA)
500kV	541	2	1,829
220kV	1,756	14	3,168
110kV	4,510	174	4329
Total	6,807	190	9,326

(Source: JSC NEGK)

◆ Current Constraints of the Transmission System in Kyrgyz[9,10,11]

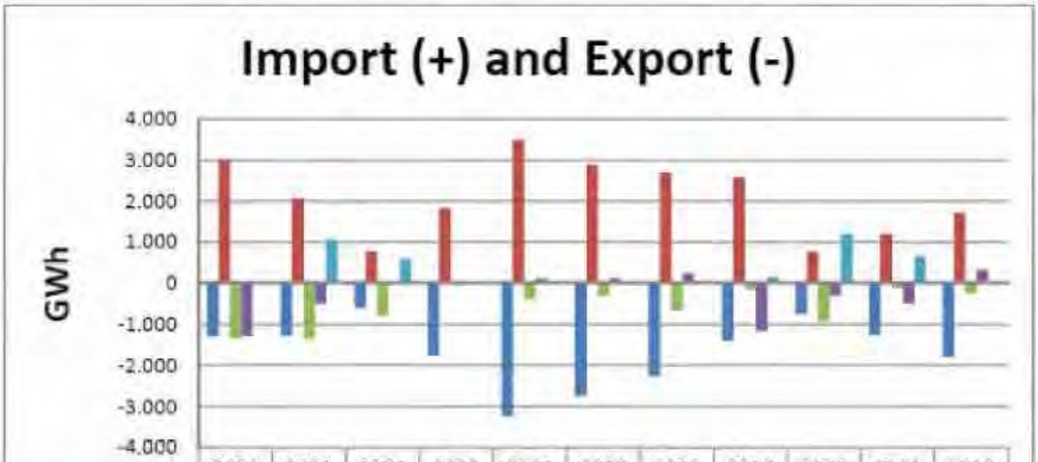
Transmission system of JSC NEGK is integrated in the Central Asia Power System (hereinafter referred to as CAPS). CAPS forms the ring-shaped transmission system, connected to the lower voltage transmission lines with the voltage 220kV and 110kV. As shown in Figure 2-4-2, Kyrgyz is the largest power exporter among the member countries of CAPS, as well as plays the crucial role from the viewpoint of stability of the power system of CAPS such as stability of frequency based on operation of the reservoir of Toktogul hydropower station. CAPS, the power system designed and constructed in the former Soviet era without regard to boundaries between republics of Soviet, interconnects bulk loads to hydro and thermal power stations in the region. However, after collapse of the Soviet Union, national interests were asserted by each country. With the development of power sources and transmission systems, Turkmenistan pulled out of CAPS in 2003, followed by secession of Tajikistan due to completion of the transmission system for own domestic power supply in 2010. At present, virtually only 3 countries, Kyrgyz, Kazakhstan, and Uzbekistan, are interconnected. Specifically, Uzbekistan takes measures for self-sufficiency of power, compromising the integrity of CAPS, thus causing the threat to stable supply of domestic power in Kyrgyz.

While over 90% of electricity is generated at hydropower stations located in southern part of Kyrgyz, the largest power consumption area is northern part of the country, including Bishkek city and Chui Oblast. The only existing 500kV transmission line passing through the domestic land, which connects the demand center in northern area to the power sources in southern area, begins at Toktogul hydropower station located in Naryn Cascade and ends at Frunzenskaya substation (500/220kV) via Alabel substation. The electricity generated at 4 other hydropower stations located downstream of Naryn Cascade, which are Kurpsai, Tash-Kumyr, Shamaldy-Sai, and Uchkurgan, is transmitted to the southern part of Kyrgyz through 220kV transmission lines connected at Lochin substation (500/220kV) in Fergana region, which is a part of Uzbekistan's power system (Figure 2-4-3).

9 SUMMARY SECTOR ASSESSEMENT: ENERGY, Power Sector Improvement Project (RRP KGZ 43456-02), ADB

10 Report and Recommendation of the President to the Board of Directors, Proposed Loan and Grant Kyrgyz Republic: Power Sector Improvement Project, September 2010, ADB

11 Final Report on Project Activities of the Kyrgyzstan Energy Advisory Services, p.67, July 15, 2011, USAID



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
KAZ-Balance	-1.288	-1.275	-604	-1.749	-3.225	-2.737	-2.260	-1.402	-747	-1.251	-1.800
KGZ-Balance	3.013	2.058	780	1.826	3.492	2.895	2.671	2.573	764	1.198	1.716
TAJ-Balance	-1.332	-1.349	-785	-44	-387	-290	-657	-153	-923	-118	-242
UZB-Balance	-1.281	-494	23	-28	120	132	247	-1.161	-294	-496	326
TKM-Balance	0	1.058	586	-5	0	0	0	143	1.200	668	0

(Source: "Energy Demand/Supply Balance and Infrastructure Constraints Diagnostics Study", October2010, ADB-RETA-6488, and "ADB - TA-7704 (KGZ) Power Sector Rehabilitation Project, Final Report", November 2012, ADB (Fichtner))

Figure 2-4-2 Trends of Power Import and Export in Central Asia through CAPS

(Source: USAID)

Figure 2-4-3 System Configuration of CAPS

The Power generated at Toktogul hydropower station flows northward through two 500kV transmission lines; 1) Toktogul - Alabel - Frunzenskaya line, and 2) CAPS. The power for Bishkek city is supplied by 220kV transmission lines from Frunzenskaya substation and by other 220kV transmission lines from Almaty substation (500/220kV) in Kazakhstan. The remaining power generated at hydropower stations in Naryn Cascade flows southward. The power flows in two directions from Lochin substation: 1) Lochin substation to Osh and Batken Oblasts through 220kV and 110kV transmission lines, and 2) Lochin substation - CAPS - Almaty substation - 220kV transmission lines to northern part of Kyrgyz. The current transmission method in Kyrgyz is at risk of stable power supply in terms of the following 3 points:

1. There is only a 500kV transmission route which connects power sources in the southern area and the demand center located in the northern part of the country. This situation may lead to interruption in power supply in most of the northern area if it is not possible to get power interchange from neighboring countries in the case of transmission line failures.

2. The power supply to Bishkek city and northern area is subject to constraint of transformer capacity at Frunzenskaya substation. Out of total output (1,200MW) of Toktogul hydropower station, more than 860MW[12] is not able to be supplied to the northern area including Bishkek city without using the transmission lines which pass through both Uzbekistan and Kazakhstan.

3. Kyrgyz does not have direct control over the power supply to the southern area of the country. As mentioned above, the power from the 4 hydropower stations in Naryn Cascade (Kurpsai, Tashkumyr, Shamaldysai, and Uchkurgan) flows southward and returns to Kyrgyz at Lochin substation in Uzbekistan via 220kV transmission lines. This way of supply to the south exposes Kyrgyz to risk that it would not be able to maintain the alternative route to the south when Uzbekistan decides to secede from CAPS and disconnect the transmission lines from Lochin substation for the power supply to Kyrgyz.

◆ Power System Development in neighboring Countries

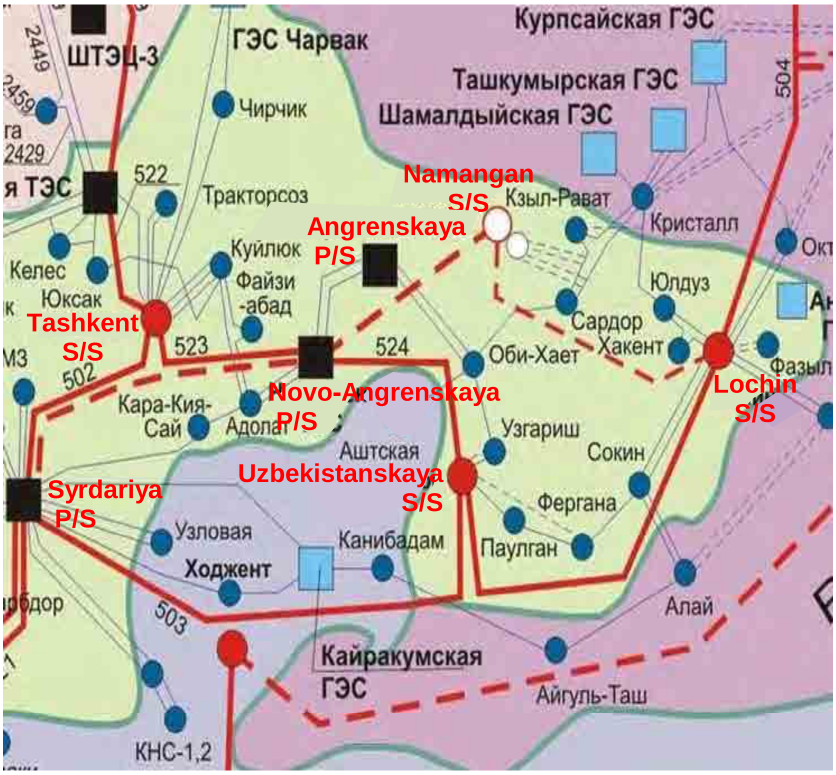
As described above, Central Asian countries have developed power sources and transmission system aiming at self-sufficiency of electricity in recent years. Situation in both Uzbekistan and Kazakhstan, which are interconnected to Kyrgyz Republic by CAPS, is the same. Facing the threat of losing one of two 500kV transmission corridors as a result of disconnection of the line by Uzbekistan and/or Kazakhstan at their own discretions as power system development advances in the two countries, Kyrgyz feels a sense of danger to the situation that it would not be able maintain power supply to northern area. The outline of the power system development in Uzbekistan and Kazakhstan is described below.

(1) Uzbekistan

On July 10th, 2009, Uzbekistan publicly announced commissioning of the first unit of the 500kV Uzbekistanskaya substation. The substation is located midway in an existing 500kV transmission line (L-503 line) which connects Syrdariya power station to Lochin substation. Besides, a new 500kV transmission line from the Uzbekistanskaya substation and Novo-Angrenskaya power station started operation. Furthermore, construction of another new transmission line connecting a new 500kV Namangan substation, Novo-Angrenskaya power station, and Lochin substation was commenced (Figure 2-4-4). In Fergana basin, reconstruction of 220kV transmission lines is under way. With such enhancement of the transmission system with voltage 500kV to 220kV, the conditions for direct supply to the demand center in Fergana region from Uzbekistan's primary system without depending on power sources in Naryn Cascade have gradually been developed, thus enabling itself to make a decision to secede from CAPS by its own discretion, as well as obtaining the diplomatic advantage that Uzbekistan can resort force to disconnect the CAPS at Lochin substation to interrupt power supply to southern part of Kyrgyz. Consequently, Uzbekistan has been in a strong position in getting

[12] The total capacity of the transformers in Frunzenskaya substation is 1,000MVA (500MVAx2).

concession in power interchange and other issues from Kyrgyz.

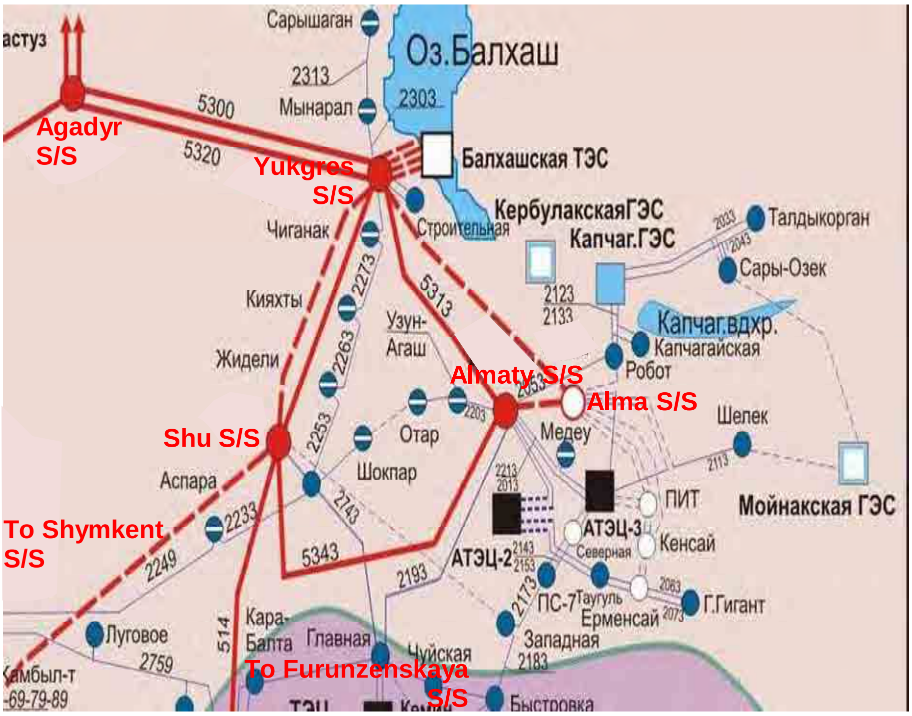


(Source: Excerpt from the Material provided by MEI)

Figure 2-4-4 Power System Development in Uzbekistan

(2) Kazakhstan

Kazakhstan completed construction of the second 500kV transmission line connecting north and south of the country in September 2009. Also, 500kV Shu substation started operation. With this power system development, power supply from the power sources in the north of the country to the demand center in the south becomes possible. Such power system developments make it possible for Kazakhstan to put isolated system operation from CAPS with disconnecting all the 500 to 220kV transmission lines (Figure 2-4-5). Secession of Uzbekistan and Kazakhstan from CAPS affects the power supply in Kyrgyz in that 700MW to the northern area becomes unable to be transmitted, thus resulting in power shortage about 700MW, and that 600MW to the southern area through the transmission lines with 220kV and below becomes unable to be transmitted, resulting in power shortage in the southern area.



(Source: Excerpt from the Material provided by MEI)

Figure 2-4-5 Power System Development in Kazakhstan

◆ Impact of water use of Toktogul HPP to be given to power system operation

Toktogul reservoir has the ability to adjust water use for several years. The water use thereof has a great influence not only for power generation of Toktogul HPP but also for irrigation of the downstream country. Therefore, with regard to discharge from Toktogul reservoir, the Inter-Governmental Irrigation Agreements (IGIA) is signed every year among the neighboring countries. In summer, the power demand in Kyrgyzstan is lower than the other seasons and accordingly the water use of Toktogul reservoir is reduced, but it is still required to much discharge for the irrigation of downstream countries. In the agreement, it becomes possible to export the surplus electric power generated in summer to the neighboring countries. On the other hand, in winter, there is a need for using water from Toktogul reservoir for power generation due to in the season of power shortage. However, in accordance with the agreement, the water shall be kept in the reservoir for irrigation of the next coming summer season. Instead of this, the neighboring countries shall export, at low prices, the thermal power fuel and electric power to Kyrgyzstan in winter, according to the agreement. Under the circumstances mentioned above, the agreement has become extremely complicated content, while revision consultation of the agreement is carried out on a regular basis.

The fulfillments of the agreement by Kyrgyzstan are;

- Be exporting electric power from Toktogul HPP to the CAPS at any time and no charge with maximum output of 300MW required for the system stability of frequency and voltage
- Be less than 650m3/s of discharge from Toktogul reservoir in winter at the tolerable level to the downstream countries

In addition, there is a policy in Kyrgyzstan that power supply to the domestic consumers is the highest priority and power export in winter is not acceptable to the neighboring countries.

3. Distribution Facilities

There are 4 regional distribution companies in Kyrgyz (JSC Severelectro, JSC Oshelectro, JSC Jalal-Abadelectro, and JSC Vostokelectro). They purchase power from NEGK and small hydropower generation companies and monopolize the supply of power in the areas for which they are responsible[13]. Distribution companies own, maintain, and repair 35kV, 6-10kV, and 0.4kV distribution facilities. The service area of each distribution company is shown in Figure 2-4-6. Out of the 4 regional distribution companies, JSC Severelectro is the largest distribution company and supplies power to Bishkek city, the largest power consumption area, Chui Oblast, and Talas Oblast. As of 2012, the power consumption of the area accounts for approximately 52% (5,770 GWh) of the total power consumption (11,159 GWh) of Kyrgyz[14].

(Source: USAID Kyrgyz Energy Sector, November 8, 2010)

Figure 2-4-6 Service Area of Distribution Companies

The distribution facilities as of 2012 are summarized in Table 2-4-3. The total length of the distribution line is 57,357km. The number of 35kV distribution substation is 336 units, and the number of units of 10/0.4kV and 6/0.4kV transformers is 20,963 units. Out of this, the proportion of the equipment that needs complete replacement is summarized by distribution companies in Figure 2-4-7. Figure 2-4-8 depicts the proportion of the distribution facilities owned by each distribution company to the total amount of facilities. These figures indicate that a large portion of the equipment of both JSC Severelectro and JSC Oshelectro, which accounts for more than 60% of the total amount of distribution facilities, needs complete replacement. Especially, the overhead distribution lines, distribution cables, and transformers with the voltage less than or equal to 10kV have a substantial need for complete replacement. The principal causes of necessity of replacement are 1) significant aging of the equipment which was installed or constructed in Soviet era, 2) degradation of the equipment owing to lack of necessary repair works due to lack of finance, and 3) overload due to capacity shortage of the conductors and transformers led by lack of necessary capital investment in upgrading the facilities corresponding to increase in the power demand in urban area in recent years.

[13] "Kyrgyzstan's Energy Sector: A Poverty and Social Impact Assessment" (Draft), Commissioned by UNDP's Regional Bureau for Europe and CIS, p.17, April 2011

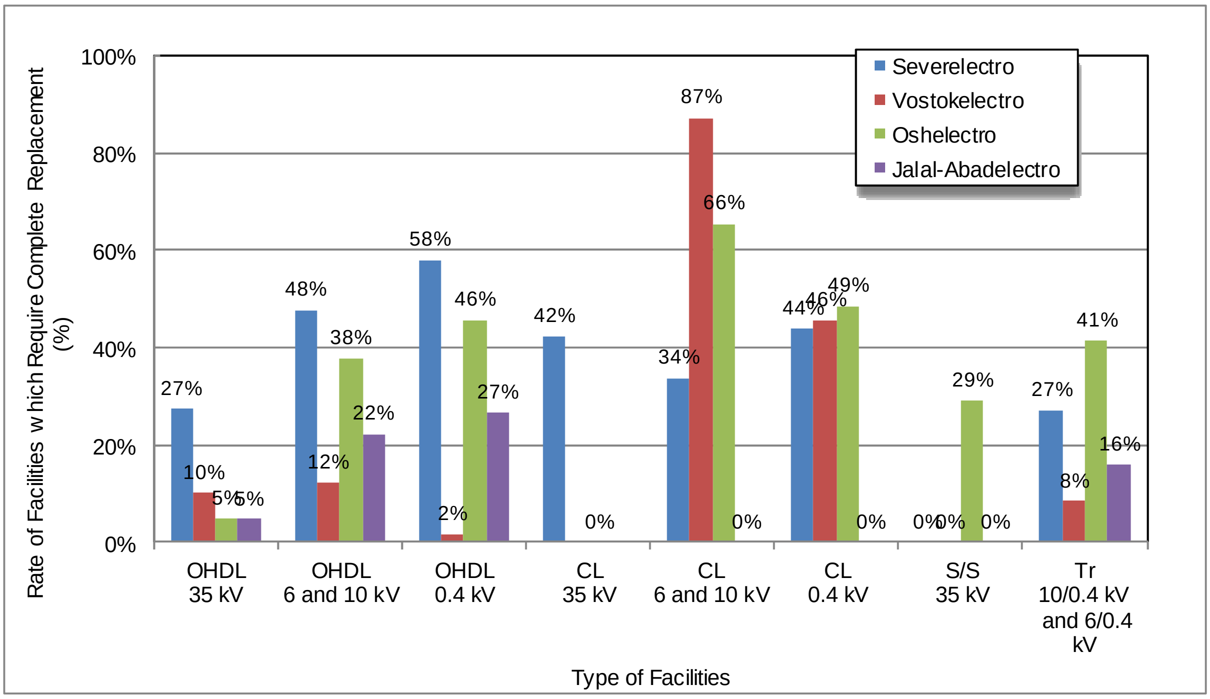
[14] Here, electricity in flow into distribution companies' distribution grid from JSC NEGK's transmission grid is defined as the electricity consumption

Table 2-4-3 Distribution Facilities in Kyrgyz (As of 2012)

Company	Total Length of Distribution Lines by Types (km)							Number of Substations and Transformers (units)	
	OHDL 35 kV	OHDL 6 and 10 kV	OHDL 0.4 kV	CL 35 kV	CL 6 and 10 kV	CL 0.4 kV	Total	S/S 35 kV	Tr 10/0.4 kV and 6/0.4 kV
Severelectro	1,320.0	7,806.0	10,914.0	59.0	1,057.0	887.0	22,043.0	122	8,605
Complete Replacement Required	361.0	3,733.0	6,336.0	25.0	358.0	389.0	11,202.0		2,335
	27.3%	47.8%	58.1%	42.4%	33.9%	43.9%	50.8%	0.0%	27.1%
Vostokelectro	1,052.9	6,424.5	5,125.7		61.4	37.2	12,701.7	63	4,529
Complete Replacement Required	106.5	791.1	92.1		53.6	17.0	1,060.3		382
	10.1%	12.3%	1.8%		87.3%	45.7%	8.3%	0.0%	8.4%
Oshelectro	1,275.1	5,888.0	5,772.0	15.0	169.1	185.6	13,304.8	86	4,511
Complete Replacement Required	63.4	2,230.0	2,642.0		110.8	90.2	5,136.4	25	1,872
	5.0%	37.9%	45.8%	0.0%	65.5%	48.6%	38.6%	29.1%	41.5%
Jalalabadelectro	959.8	3,676.6	4,586.4		63.2	21.5	9,307.5	65	3,318
Complete Replacement Required	45.0	821.6	1,223.7				2,090.3		529
	4.7%	22.3%	26.7%		0.0%	0.0%	22.5%	0.0%	15.9%
Total	4,607.8	23,795.1	26,398.1	74.0	1,350.7	1,131.3	57,357.0	336	20,963
Complete Replacement Required	575.9	7,575.7	10,293.8	25.0	522.4	496.2	19,489.0	25	5,118
	12.5%	31.8%	39.0%	33.8%	38.7%	43.9%	34.0%	7.4%	24.4%

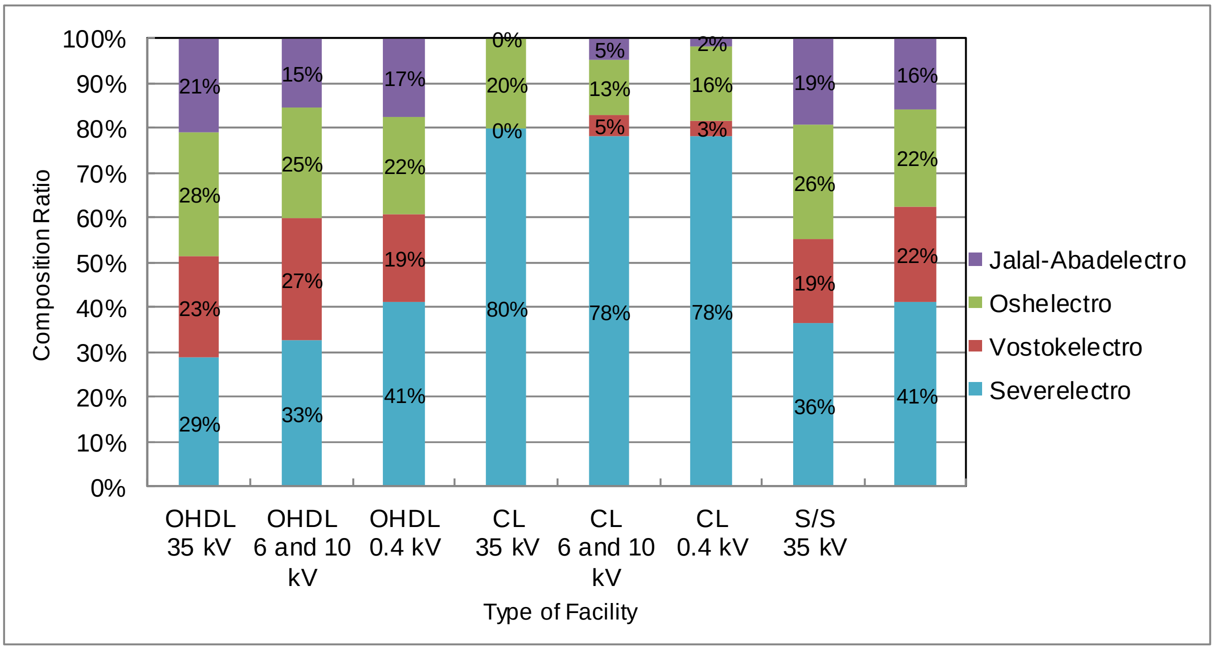
*OHDL: Overhead Distribution Line, CL: Cable Line, S/S: Substation, Tr: Transformer

(Source: MEI, edited by JICA Survey Team)



(Source: MEI, edited by JICA Survey Team)

Figure 2-4-7 Distribution Equipment which needs Complete Replacement



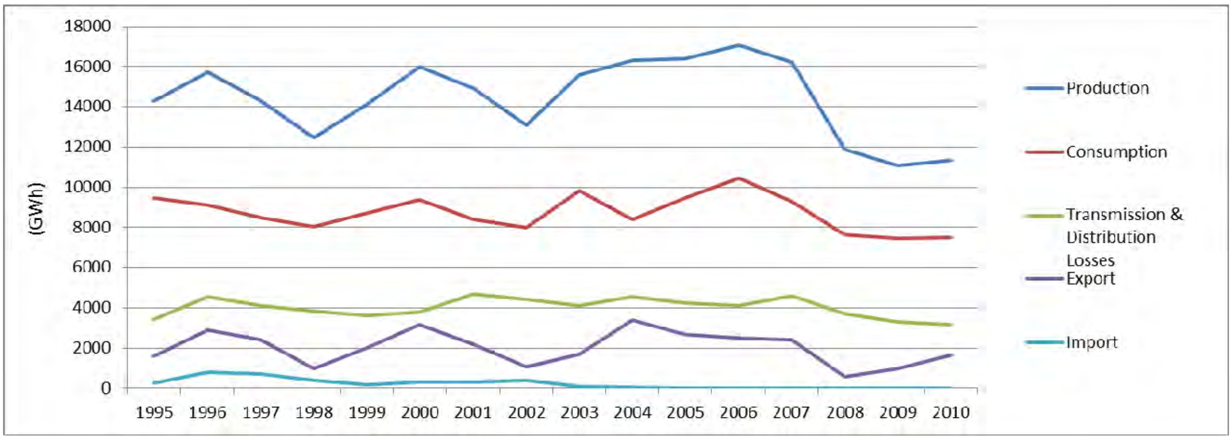
(Source: MEI, edited by JICA Survey Team)

Figure 2-4-8 Proportion of Distribution Facilities of each Distribution Company to the Total Facilities in Kyrgyz

2-4-2 Power Demand and Supply

The electrification ratio of whole Kyrgyzstan has achieved almost 100%, although 21 small-scale un-electrified areas exist. In addition, un-electrified area does not exist in Chui Oblast.
Annual power supply in 2010 is 11,450 GWh, out of which the amount of actual electricity sales to 10.8 million of consumers has become 6,091 GWh. The remaining 4,641 GWh is system loss, which indicates a high loss rate at approximately 40% of the total.

In order to understand the characteristics and performance of the power supply in the past, the production of power generation, consumption, transmission and distribution losses, export and import from 1995 to 2010 are shown in Figure 2-4-9. Here, "production + import = consumption + export + transmission and distribution losses" is formed.



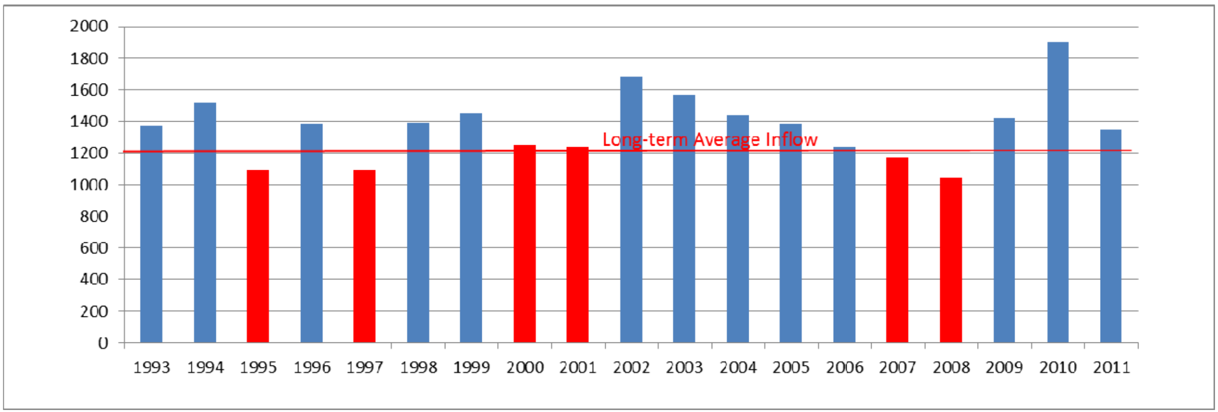
(Source: The World Bank DataBank/ADB Key Indicators 2012)

Figure 2-4-9 Trends of Power Supply and Consumption

In the figure above, production and consumption have some variation, but an increasing trend is not seen in the past 15 years. Comparing the data of the maximum production of 1996 and 2006, production made a slight increase at 0.9% per annum from 15,729 GWh to 17,082 GWh.
The transmission & distribution losses has been approximately 4,000GWh at a high level, about 20-40% of the overall power generation. On the other hand, electric power export has variation and has far exceeded electric power import which has decreased in recent years and remained at a low level.

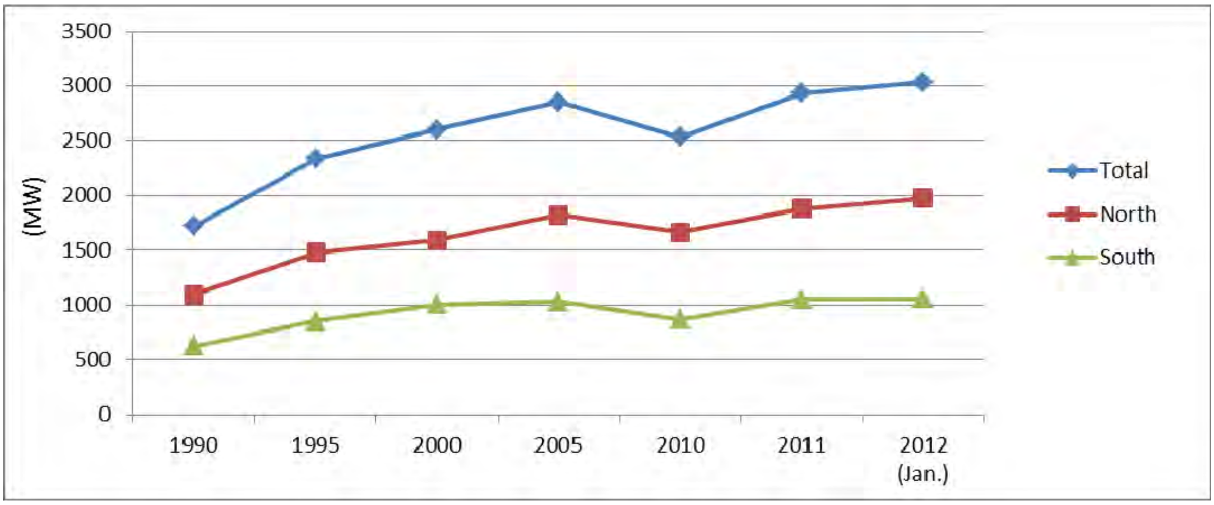
In order to check the relation between the variation in the abovementioned production of electricity and a river flow discharge, transition of the annual average river flow discharge of the Naryn River of upper stream of Toktogul reservoir from 1990 to 2011 is shown in Figure 2-4-10

In Figure 2-4-10, it is observed that, for the three periods of i) 1995-1997 years, ii) 2000-2001 year, and iii) 2007-2008 years, the annual average river flow discharge of the Naryn River is below or comparable to the long-term average inflow. Those are considered as drought years. Since Toktogul reservoir capacity can adjust the outflow for several years, the reductions of the generation production of 1998, 2002 and 2008-2010 in Figure 2-4-9 have appeared in subsequent years of the drought years corresponding to the abovementioned three periods. These also cause a variation of export and consumption. It is further observed in approximately every 5 years that decrease of generation production by approximately 15% to 25% has occurred in subsequent year of the respective drought years. It is herein noted that particular rapid decrease of production in 2010 in Figure 2-4-9 might be due to "electricity tariff increase of Kyrgyzstan in 2010" and/or "Lehman Shock caused in America".



(Source: MEI)

Figure 2-4-10 Changes in Annual Average River Flow Discharge of Naryn River (Upstream of Toktogul reservoir)



(Source: MEI)

Figure 2-4-11 Transition of Maximum Peak Outputs

Transition of the maximum peak outputs from 1990 to 2012 is shown in Figure 2-4-11.
In the last 20 years, only two (2) power plants were developed and commissioned, i.e., Shamaldy-Sai hydropower plant with installed capacity of 240 MW in 1994 and Kambarata-2 hydropower plant with installed capacity of 60 MW in 2010.
During the 15 years from 1990 to 2005, it can be considered that there are margin capacities to follow up the growth of peak demand and consequently the maximum peak output had been increased at 3.4% increase per year and totally by 65% increase during the period. However, since 2005, the margin has been dropped out in installed capacity. It is observed that the growth of the maximum peak output is at 0.9% increase per year. Nowadays in January 2012, it is in a state of total planned outages of approximately 250MW.

Figure 2-4-12 shows an actually record of annual load factor and maximum peak output. Since the annual load factor has decreased year by year, the peak demand has been stood out. The load factor of the recent year is almost constantly about 50%. This is probably because the peak demand has been limited due to lack of supply output capacity.

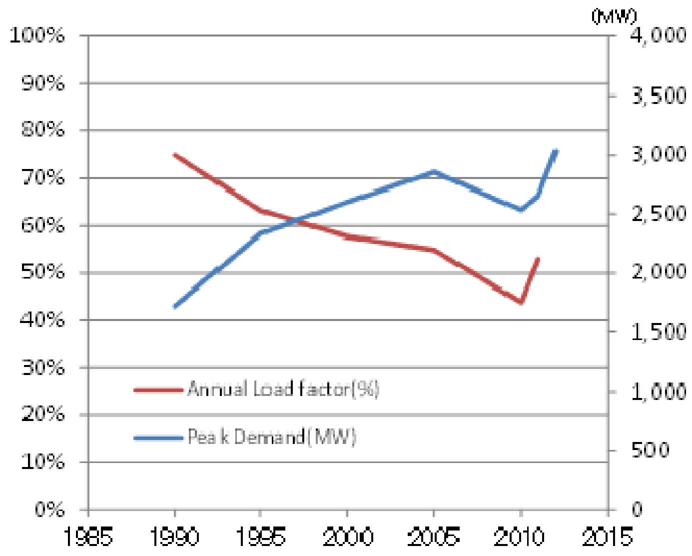


Figure 2-4-12 Annual Load Factor and Maximum Peak Output

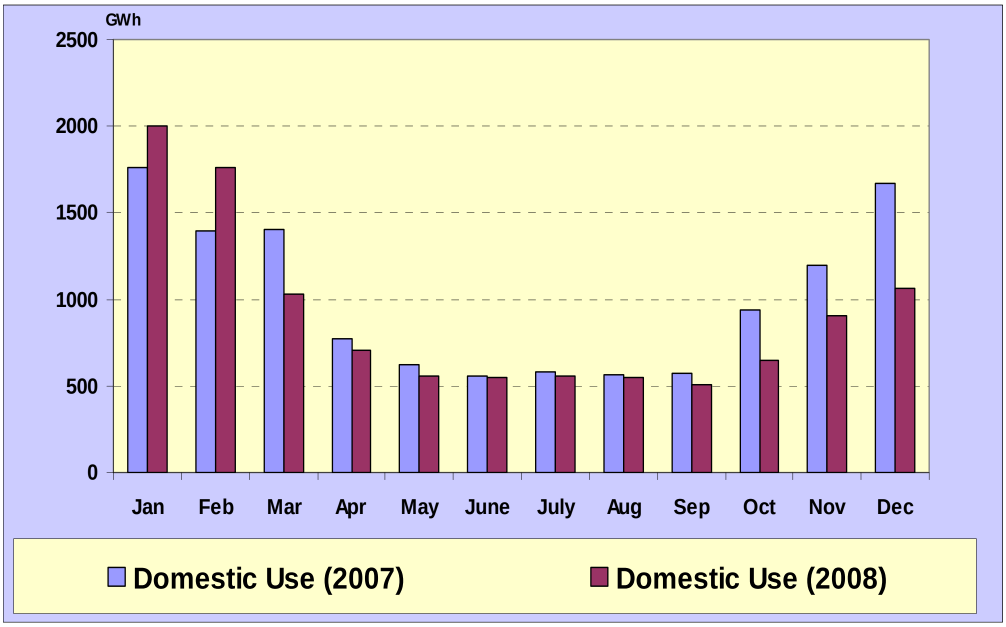
As shown in Table 2-4-4, approximately half (=48%) of generated power is to be consumed in JSC Severelectro involving Chui Oblast. Also, approximately 70% of power is to be consumed in the Northern region inclusive of JSC Severelectro (=48%) and JSC Vostokelectro (=22%), while main power resources such as Toktogul hydropower plant are existed in the Southern region, covered by JSC Jalal-Abadelectro.

As shown in Figure 2-4-13, it is seen that monthly consumption stands out by heating demand in winter season from December to February.

Table 2-4-4 Area Basis Maximum Peak Demand in winter (2012 planned)

DisCos	Area	Consumption (MWh)	Proportion	
JSC Severelectro (North)	1. Bishkek city	2,977	24%	48%
	2. Chui oblast	2,529	20%	
	3. Talas oblast	460	4%	
JSC Vostokelectro (East)	4. Naryn oblast	667	5%	22%
	5. Issyk-Kul oblast	1,341	11%	
	6. Batken oblast	784	6%	
JSC Oshelectro (South)	7. Osh oblast	1,069	9%	15%
	8. Osh City	811	7%	
JSC Jalal-Abadelectro (West)	9. Jalal-Abad City	1,806	15%	15%
Total		12,444	100%	

(Source: MEI)



(Source: USAID)

Figure 2-4-13 Trend of Monthly Power Supply (2007-2008, actual)

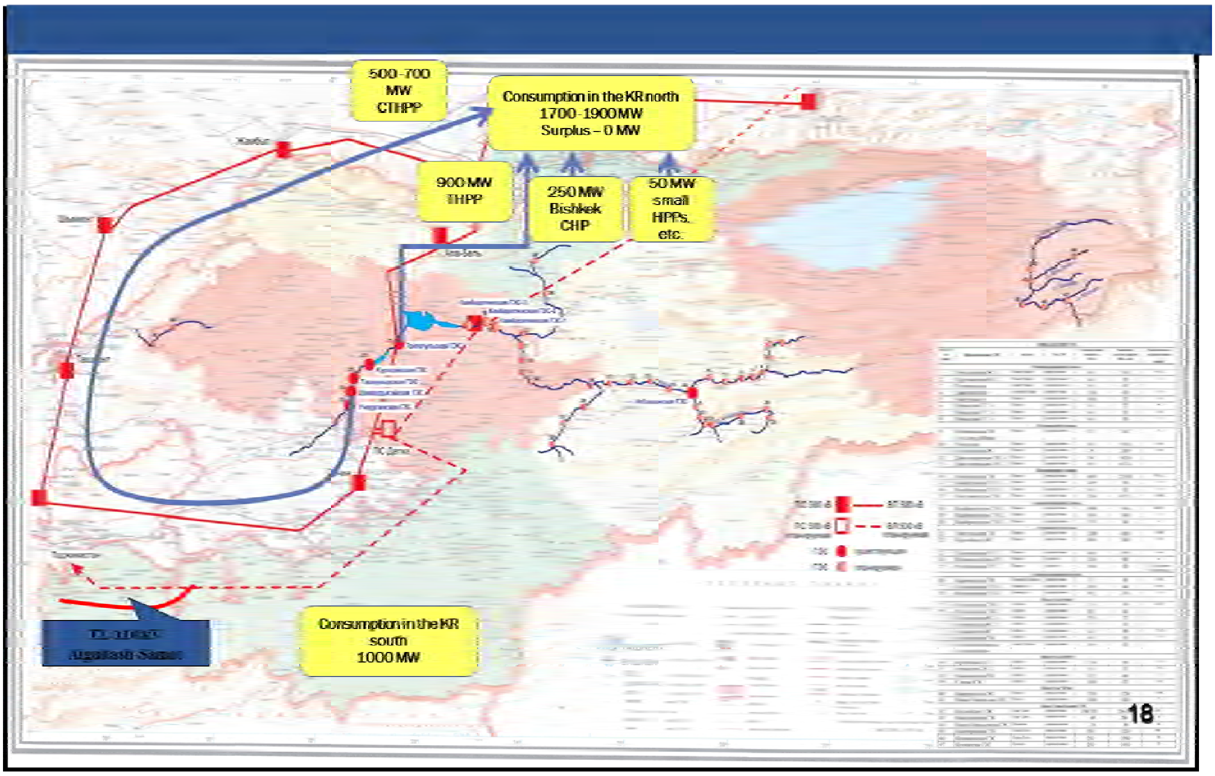
2-4-3 Maximum Output and Maximum Peak Demand in January 2012

1. Power demand and supply plan of MEI (2012, Original Plan)

MEI has planned the power supply to the northern region in winter 2012 as shown in Figure 2-4-14, but was forced to stop to supply, because the actual demand exceeds the expectation.

Overviews of power demand and supply plan of winter 2012, which MEI was originally planned, are written as follows.

- ◆ Maximum demand forecasts of the southern and the northern regions for winter season in 2012 are 1,000 MW and 1,900 MW respectively, and total 2,900MW for the whole country.
- ◆ The power supply planning for the maximum demand forecast 1,900MW in the northern region are summarized below.
  - ➢ Power supply of 900MW, generated at Toktogul hydropower plant, etc. in the southern region, to the northern region through the domestic 500kV transmission line
  - ➢ Power supply of 700MW, generated in the southern region, to the northern region through the CAPS500kV transmission line
  - ➢ Power supply of 300MW, generated at Bishkek central heating power plant and small hydropower plants in the northern region, to the same region



(Source: MEI)

Figure 2-4-14 Power Demand and Supply Plan of MEI for winter (2012, Original Plan)

2. Maximum Output

The maximum output 3,035MW for the country was recorded in January 2012. About two third (2/3) of the total were supplied to the northern region including Chui Oblast and capital city of Bishkek.

The maximum peak load 3,035MW is slightly less than 3,238 MW of available capacity of total outputs, because some of the existing power plants of a run-off-river type such as Kambarata-2 (60MW) and At-Bashi (38MW) were not fully operated due to a small river flow discharge in winter, and some other plants were under maintenance.

On the other hand, in 2012, there was a rich reservoir water of Toktogul and therefore it was possible to perform the operation at 100% for a few hours to peak demands by Toktogul hydropower plant and its downstream plants.

3. Maximum Peak Demand

The maximum peak demand cannot be directly measured because there are routinely power disconnections with blackouts in some distribution feeders due to shortage of power outputs.
For the power supply to the northern region, there is a command to stop supply, issued by NEGK to the distribution companies when the power supply is greater than 1,900 MW. Then, Distribution companies shall disconnect a distribution feeder upon area basis.

In January 2012, the actual maximum output of 1,977 MW has been recorded in the northern region. According to MEI, taking into consideration of the usual demand of the feeders for which power disconnections were done by distribution companies, it can be estimated that the total disconnected power was approximately 200MW for peak power demands in January 2012. Therefore, the maximum peak demand in the northern region can be estimated as “maximum output 1,977 MW + disconnected power 200 MW = 2,177 MW”.

For power supply to the southern region, the same manner can be applied. When the power output is greater than 1,000 MW, power disconnections were carried out by the distribution companies. Then, the maximum peak demand in the southern region can be estimated as “maximum output 1,058 MW + disconnected power 50 MW = 1,108 MW”.

As described above, the maximum peak demands in January 2012 were 2,177MW and 1,108MW in the northern and the southern regions respectively. Therefore, it is calculated that total maximum peak demand of the country can be estimated to be 3,285MW inclusive of total 250MW of disconnected power in the country.

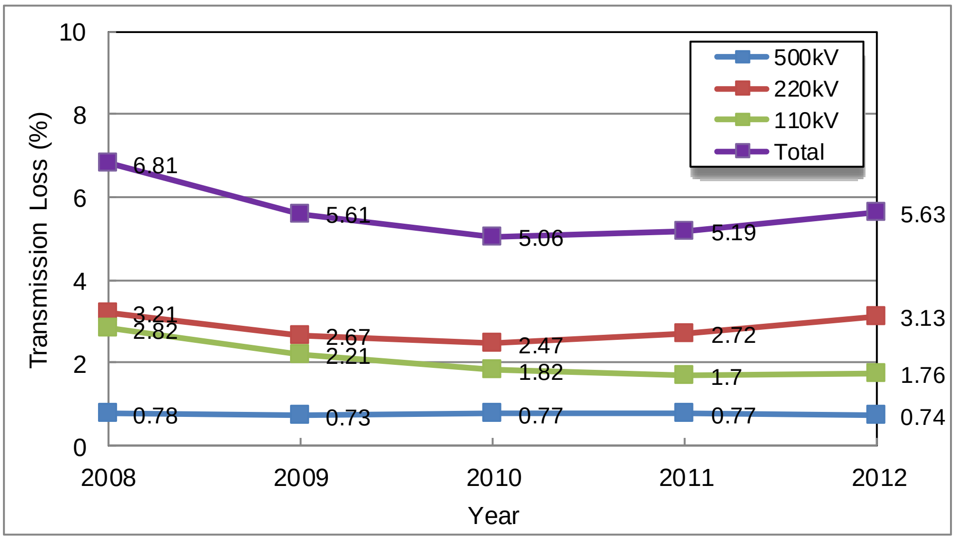
2-5 Electricity Losses

2-5-1 Transmission Losses

JSC NEGK provided the transition data of the transmission losses (technical loss) for the last 5 years, which is shown in Figure 2-5-1. There has been little change in the average for the 5 year period as 0.7% for 500kV, 2.8% for 220kV, 2% for 110kV, and 6% in the aggregate, respectively. The primary causes of the technical loss are:

1) Load loss: Conductors, Transformers, Autotransformers, and Current transformers
2) No-load loss: Transformers, Corona loss of overhead transmission lines with voltage rated to 110-500kV, losses in reactive power compensation devices and voltage transformers, etc.

On the other hand, there are virtually no commercial losses for JSC NEGK since the power flows from JSC NEGK's grid to 35kV distribution system of the distribution companies through 110/35kV transformers, thus it is impossible for general public and/or the staff who are in charge of reading the meters to tamper with the measuring instruments.



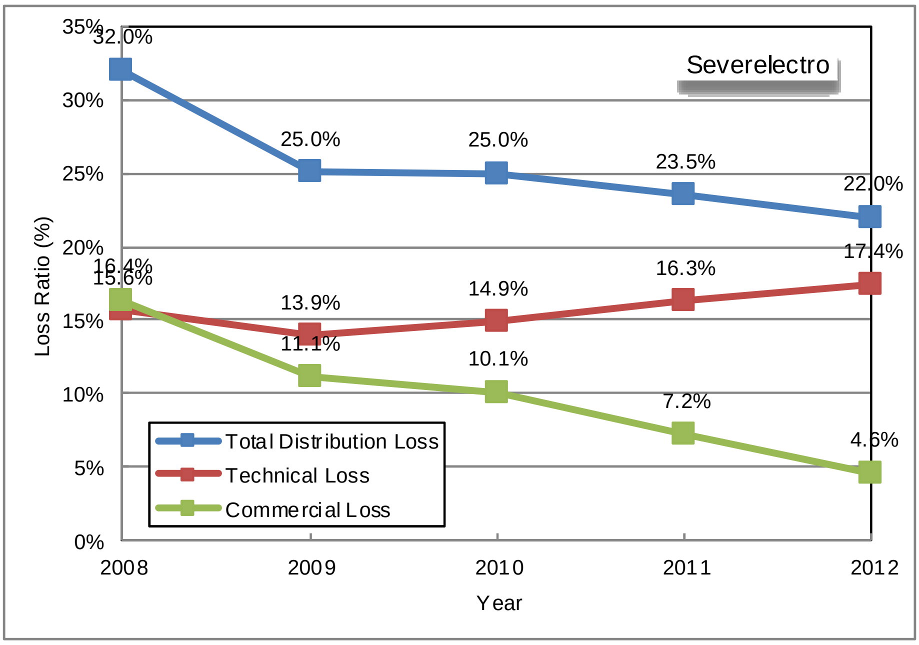
(Source: JSC NEGK)

Figure 2-5-1 Transition of Transmission Loss (Technical Loss) in the past 5 Years

2-5-2 Distribution Losses

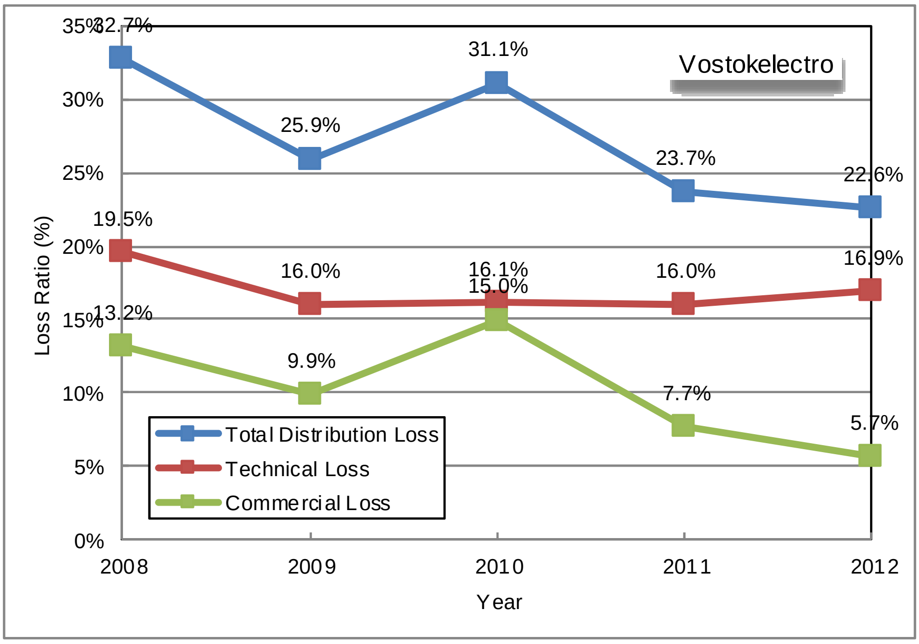
According to the data[15] on the transition of distribution loss, which was provided by MEI, total distribution losses (electricity losses) were 2,367.8GWh or 21.2% of power inflow into the grid of distribution companies in 2012. The transition of distribution losses in the past 5 years by distribution companies are shown in Figure 2-5-2 to Figure 2-5-5. The red line indicates the technical loss, green line indicates the commercial loss, and the light blue line indicates the total distribution losses. The overall distribution losses in Kyrgyz are shown in Figure 2-5-6.

15 Key Technical and Economic Indicators of DisCos, MEI



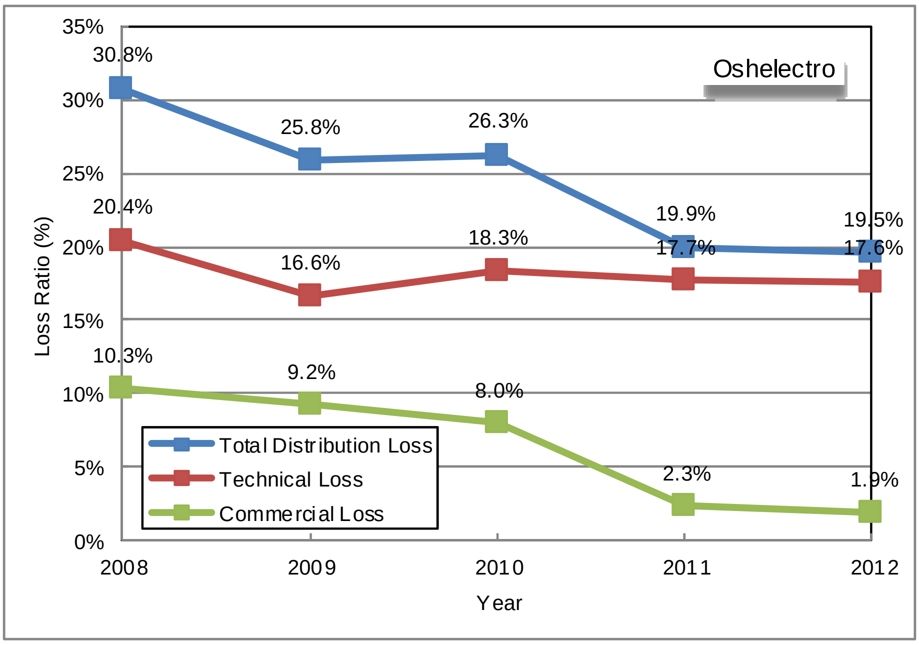
(Source: MEI)

Figure 2-5-2 Transition of Distribution Losses in the past 5 Years (JSC Severelectro)



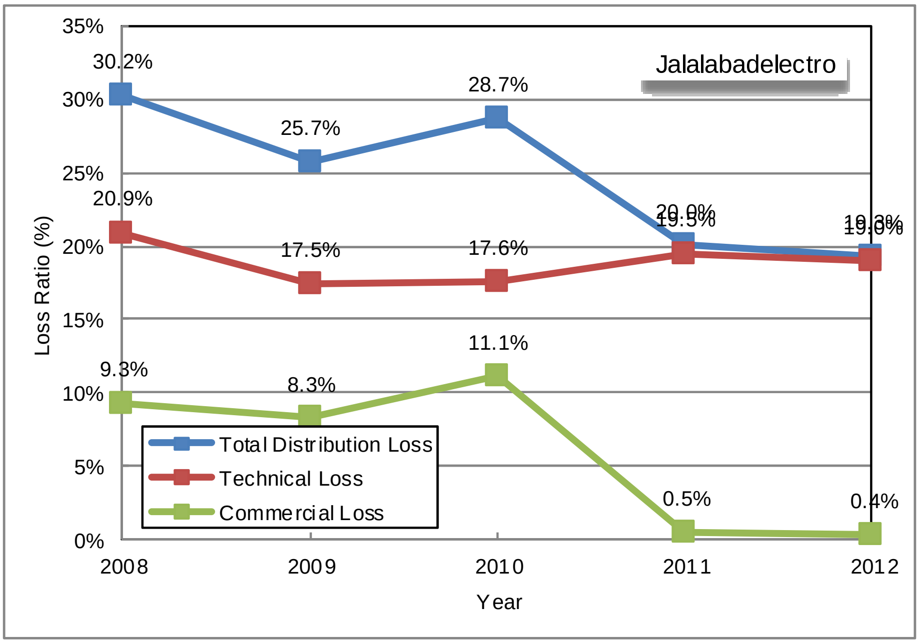
(Source: MEI)

Figure 2-5-3 Transition of Distribution Losses in the past 5 Years (JSC Vostokelectro)



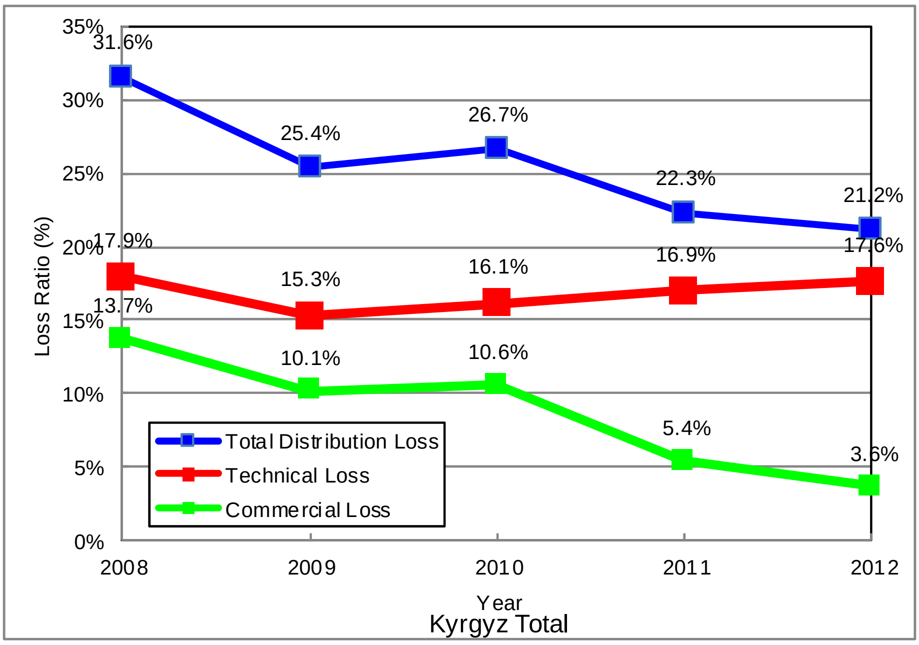
(Source: MEI)

Figure 2-5-4 Transition of Distribution Losses in the past 5 Years (JSC Oshelectro)



(Source: MEI)

Figure 2-5-5 Transition of Distribution Losses in the past 5 Years (JSC Jalal-Abadelectro)



(Source: MEI)

Figure 2-5-6 Transition of Distribution Losses in the past 5 Years (Total)

The common characteristics for each 4 distribution company is that, from 2010, the commercial losses have rapidly decreased, and that the technical losses do not seem to be reduced at all in contrast. The primary causes of high technical losses are 1) aging of the equipment which was installed in Soviet-era and 2) overload due to high electric load that exceeds the installed capacity of the old equipment. The facility design was done in order to meet the expected power demand in 1960s and ’70s. The current power consumption by households exceeds way beyond the old one, thus resulting in overload of the distribution facilities. According to the hearing investigation to JSC Severelectro, there are still many old conductors with small diameters for 35kV, 10kV, 6kV, and 0.4kV distribution lines, which do not have enough transmission capacity for supplying to the loads. Besides, deterioration of 6-10/0.4kV transformers, overload of 35/6-10kV transformers, and existence of the bottle neck points where the diameters of conductors change to smaller ones in the same line in that the transmission capacity of the conductors with smaller diameters are not enough to supply power to the receiving ends are ascribed as the crucial causes of the technical losses.

As the technical loss reduction countermeasures, in Bishkek city and Osh city, such activities as construction of new 35kV substation, replacement of 35/10-6kV and 6-10/0.4kV (new construction of a 35/6-10kV Dostuk substation and a part of the transformer replacement project in Osh city were financed by WB) transformers, replacement of conductors to that with larger diameters for 35kV, 6-10kV, and 0.4kV overhead distribution lines, and replacement of cables to that with larger diameters for 10kV and 0.4kV underground distribution lines (6-10kV cable replacement project in Bishkek city was financed by KfW) have been implemented by JSC Severelectro and JSC Oshelectro, respectively.[16] Nevertheless, the figures do not indicate significant reduction in the distribution losses both for JSC Severelectro and JSC Oshelectro as the technical losses increased from 16.3% (2011) to 17.4% (2012) for JSC Severelectro, and the losses remain roughly flat from 17.7% (2011) to 17.6% (2012) for JSC Oshelectro, respectively.

The average commercial losses in Kyrgyz had been as high as approximately 11.5% in 3 years from

[16] “Main activities aimed at uninterruptible power supply of Bishkek city as of 2012”, “Main activities aimed at uninterruptible power supply of Osh city as of 2012”, MEI

2008 to 2010 as a whole due to inaccurate functioning of meters, fraudulent activities by controllers (taking kickbacks from the customers in reward for making false entries (smaller values than actual reading) to the reading record) who are in charge of reading the electricity meters at customers' premises, tampering of the meters by specialists who are in charge of replacement of electricity meters, power theft by public without contract for electricity use, and non-payment of bills. As the prevention measures against the fraudulent activities by controllers and specialist, Severelectro has implemented the project for replacement and installation of smart meters suitable for remote reading and cut off the consumers who do not pay the bill by the loan fund of KfW. As of 2012, 230 units of the new meters have been installed to the customers on trial. The future installation plan is as follows:

- Installation in the line of power supply from the suppliers: 637 units
- Installation in the line between regional electricity company, and 35/6-10kV substations: 1,163 units
- Installation at 6-10/0.4kV transformers: 13,000 units
- Installation to all customers: 495,000 units (plan to install 110,000 units from 2013 to 2016)

A corresponding data acquisition and transmission device installation is planned. With installation of the system, JSC Severelectro plans to abolish the meter reading by controllers. Also, each distribution company pursues prevention measures against power theft by hooking through replacement of bare conductors by coated conductors.

As mentioned above, some distribution companies have taken measures for commercial loss reduction. Although the distribution loss in Kyrgyz as a whole was improved, in number, to 3.6% in 2012, the two-year average of the losses for JSC Oshelectro and JSC Jalal-Abadelectro in 2011 and 2012, which are shown in Figure 2-5-3 and Figure 2-5-4, range as little as 2 to 0%. Therefore, such small values don't seem to be a serious problem. On the other hand, the Power Sector Development Strategy over the period 2012-2017 (Draft)[17] regards high commercial losses caused by power theft, fraud, and non-payment of bills as one of the key operational issues in the power sector activity. JSC Severelectro, the largest distribution company that accounts for nearly a half of the total power demand in Kyrgyz, takes the lead in commercial loss reduction through a variety of projects such as installation of smart meters with the support of donors. It is questionable that the commercial losses for the other three distribution companies have rapidly decreased during the past 3 years although it does not seem to have any special activities for commercial loss reduction implemented in the companies. Hence, it would be necessary to fully examine the credibility of the loss data.

In regard to the high technical losses in spite of implementation of capital investments for refurbishment of obsolete facilities, the USAID report[18] stated "When distribution companies have such a high level of allowed technical losses and in fact they are lower, then the company is able to disguise some portion of its commercial losses as technical loss." In the same report, there is the description that the employees of Vostokelectro explained that the calculation of the technical losses was based on the standard assumptions which was designed in Soviet-era, that the planned, in other words, allowed technical losses equaled to 17% of the generated power, and that the company considered the losses exceeding 17% as the commercial loss[19]. This may suggest a certain relationship with the trend that the technical losses of each distribution company have remained around 17%. Further study is necessary to conclude whether there is obvious relationship between the description in the USAID report and the trend of the technical losses of the distribution companies.

17 Power Sector Development Strategy over the period 2012-2017 (Draft), MEI
18 Management Diagnostic of the Electricity Distribution Companies of the Kyrgyz Republic, Report on Phase 1: Preliminary Findings & Recommendation, p.2, March 31, 2011, USAID
19 "Report of Phase 1: Preliminary Findings & Recommendation", p.19

2-6 Development Plan of Electric Power Facilities

Power sector development strategy is specified by the government in "Power Sector Development Strategy over the period 2012-2017(PSDS2012-2017) / MEI", in which the following three (3) outcomes are targeted.

- To improve power supply reliabilities by enhancing the capacity of power system facilities
- To build the domestic power system which is independent from the neighboring countries
- To enhance power system facilities to accelerate power exports to the neighboring countries for foreign currency earnings.

The power system development plan and distribution expansion plan are summarized in the abovementioned PSDS2012-2017.

2-6-1 Power development plan

Power development plan of Kyrgyzstan is shown in Table 2-6-1.
New power development plans are described in the abovementioned PSDS2012-2017. As for rehabilitation plans of existing power plants, the latest information were interviewed with JSC EPP and others. Also, "Strategic Planning for Small and Medium Sized Hydropower Development (MEI & EBRD, July 2011)" are referred to as the latest information of small hydropower development plan.

1. <u>Kambarata-2 HPP # 2 (120MW), New Project</u>

Kambaata-2 HPP is planned to be the total of three (3) units from No. 1 to No. 3 with the total installed capacity of 360 MW (120MW x 3units). As the part of above, the unit 1 started the operation as the Kambarata-2 HPP # 1 (120MW) in 2010. Also, the unit 2 (the HPP # 2 (120MW)) has been already constructed at 90% of the tunnel excavation drilling. But the construction was stopped due to some cash flow problems. MEI is still aiming to its own funds for the remaining construction activities however a prospect of the funds has not yet been cleared by MEI. As for the construction of unit 3, there is no definite activity at present.

2. <u>Kambarata-1 HPP (1900MW), New Project</u>

The new project of Kambarata-1 HPP is planned to be investigated by "RusHydro & InteRAO" and "JSC EPP" at 50% of share for each. These companies will establish a Special Purpose Company (SPC). An agreement between the Government of Kyrgyzstan and the Government of Russian has been signed in September 2012. In the agreement, there is a provision that the half of electricity will be exported to neighboring countries, and remaining of power will be supplied for the domestic usage. Currently, the feasibility study was started by consultants of Canada. The government of Kyrgyzstan is expected to complete the feasibility study and design works in 2013. From 2014 the construction will be started and commercial operation is expected to be commenced in 2021 with an assumption that the construction period is 8 years.

Table 2-6-1 Power Development Plan

No.	Donor	Name of the Project	Implementing partner/Contractor	Implementation Period	Amount (in original currency)	Budget support/grant/loan/ other
Power Plant for New Development						
1	Gov. of KR	Kambarata-2 HPP #2 (120MW)	JSC EPP	2014-2015	$100 million	Own budget, not yet prepared
2	Russian federation	Kambarata-1 HPP (1900MW)	SPC (*)	2014-2021	$2850 million	IPP
3	Russian federation	Upper Naryn Caskade of 4 HPPs (191MW)	SPC (*)	2014-2021	$412 million	IPP
4	-	Kara-Keche coal TPP (600MW)	JSC EPP	-	$700 million	Not yet decided
5	EBRD (**)	4 small HPPs - Sokuluskaya-5(1.5MW) - Tortgulskaya(3.0MW) - Oy-Alma(7.7MW) - Orto-Tokoskaya(20MW)	Privates	2014-2016 2014-2016 2014-2018 2014-2017	$5.9 million $4.7 million $26.7 million $38.7 million	Laon, Biddings for IPPs
Power Plant for Rehailitation						
6	ADB	Toktogul HPP (1200MW) Phase-1	JSC EPP	2012-2016	$55 million	Grant & Loan
7	SECO (Swiss)	At-Bashinskaya HPP (40MW)	JSC EPP	2013-2017	CHF 24 million	Grant
8	Shanhai federation (China)	Bishkek Central Heating PP (400MW)	JSC EPP	2015-2016 (Assumption)	$300 million	Loan, not yet approved (***)
9	Shanhai federation (China)	Uch-Kurgan HPP (180MW)	JSC EPP	2016-2018 (Assumption)	$50 million	Loan, not yet approved (***)

<NOTES>
(*) SPC (Special Purpose Company); SPC of Russian companies (“Rushydro” & “Interao”) and JSC “EPP” will be established for development of Kambarata-1 HPP and Upper Naryn cascade of 4 HPPs. The Russian Federation will be financing to the “Rushydro” & “Interao”.
(**) EBRD is under taking the technical assistance for preparation of tendering upon No.5, and also interested in financing to the 1st bidder of 4 small HPPs.
(***) JSC “EPP” has already requested the fund for rehabilitation of No.6 and No.7 to "the Shanhai Federation", and has been still waiting for the reply.

(Source: Power Sector Development Strategy over the period 2012-2017/MEI, etc.)

3. Upper Naryn Cascade of 4 HPPs (191MW), New Project

This new project consists of the four (4) hydropower cascade plants, i.e., Akbulun HPP, Naryn HPP No.1, No.2 and No.3, all of that are located at the upstream of Naryn River basin. This project is also planned to be investigated by “RusHydro & InteRAO” and “JSC EPP” at 50% of share for each. These companies will establish a Special Purpose Company (SPC) together with the abovementioned Kambarata-1 HPP.

4. Kara-Keche coal TPP (600MW), New Project

Kara-Keche coal thermal power plant (600MW), located nearby Kara-Keche coal mine, is planned to be mainly generated for power exports to Kazakhstan. According to MEI, there is a possibility that the procurement of construction funds could be arranged by Kazakhstan however at the moment there is not practical action.

5. Four (4) small HPPs (Sokuluskaya-5(1.5MW), Tortgulskaya(3.0MW), Oy-Alma(7.7MW) and Orto-Tokoskaya(20MW)), New Projects

The master plan on small and medium-sized hydropower development of the country was conducted in July 2011 and reported in "Strategic Planning for Small and Medium sized Hydropower Development (MEI & EBRD)". Also, the feasibility study was carried out for the four (4) promising sites selected in the abovementioned master plan. EBRD has created the draft tender documents of the abovementioned four (4) sites and has submitted it to MEI recently, according to MEI. The tender for those small hydropower developments will be carried out by MEI in August 2013 as first experience in the country. In addition, according to MEI, some loan assistance from EBRD can be available to a developer selected in the tender however the details are unknown.

6. Toktogul HPP(1200MW), Rehabilitation Project

Toktogul HPP (1200MW) has been operated since 1975 and has been aged recently. Currently, rehabilitation works under supporting of ADB is started. There are totally three (3) phases for the overall rehabilitation planning.

- As 1st phase for the rehabilitation works, the rehabilitation of runner, governor, switch, etc. has been ongoing since 2012, supported by ADB with USD 55mil. of the loan and grant aid. It is scheduled to be completed in 2016.
- As 2nd phase for the rehabilitation works, ADB is interested in a renovation of the turbine and generator of unit 2 and unit 4. Each unit capacity is 300MW. Estimated cost thereof is approximately USD 140-160mil. The feasibility study will be carried out from 2015 and will be completed in 2017 as the target. It can be generally expected that those kinds of renovation works could be resulting in some output increase at 15 to 20%, i.e., approximately 100MW, of the existing capacity (600MW).
- Finally, as 3rd phase for the rehabilitation works, the renovation works are considered for unit 1 and unit 3. The works will be executed as the same manner of the abovementioned 2nd phase.

7. At-Bashi HPP (40MW), Rehabilitation Project

At-Bashi HPP has been operated since 1970 and aged for more than 40 year. Currently, its output power is decreasing till 38MW while the installed capacity was originally 40MW. Also, a lot of maintenance costs are required year by year for keeping the proper operation. The renovation works for turbine and generator are to be started in 2013 as a grant aid project (CHF 24 mil.) supported by SECO (Switzerland), which is scheduled to be completed by 2017.

8. Bishkek Central Heating PP (400MW), Rehabilitation Project

Bishkek Central Heating PP has been operated since 1961. The operation has been continued during more than 50 years, and accordingly its output power has been decreasing till 250MW while the original installed capacity was 400MW. Consequently, JSC EPP tries to change the main equipment such as the boilers and generator aiming for efficiency improvement, reduction of maintenance costs, a stable power supply to the Bishkek city, etc.. JSC EPP has already requested a loan to Shanghai Federation of China for the renovation works thereof however any reply has not come from China.

On the other hand, WB is currently under consideration regarding rehabilitations of the boiler, which is expected to be an assistance of approximately USD15 to 20mil. and to be completed by 2015 to 2016.

9. Uchkurgan HPP (180MW), Rehabilitation Project

Uchkurgan HPP has been operated since 1961. The operation has been continued for more than 50 years, and accordingly its output power has been decreasing till 175MW while the original installed capacity was 180MW. Consequently, JSC EPP tries to change the main equipment such as the turbines and generators aiming for efficiency improvement, reduction of maintenance costs, a stable power supply to the grid, etc.. JSC EPP has already requested a loan to Shanghai Federation of China for the renovation works thereof however any reply has not come from China. Currently JSC EPP is still looking for a new source of funds.

2-6-2 Power System Development Plan

As mentioned in 2-4-1, Kyrgyz has the issues on stable power supply inherent in its present transmission system. In order to cope with the issues, a variety of transmission system expansion and refurbishment projects have been planned and implemented under the financial assistance by international donors. The prospective and ongoing projects of JSC NEGK for 2013-2017 are summarized in Table 2-6-2.

Table 2-6-2 JSC NEGK's Transmission System Expansion & Refurbishment Projects supported by Donors

No.	Donor	Name of the Project	Implementing partner/Contractor	Implementation Period	Amount (in original currency)	Budget support/grant/loan/ other
Approved Projects						
1	ExIm Bank (China)	Construction of 500kV Datka-Kemin transmission line and 500kV Kemin	JSC NEGK	2012-2015	$389.795 million	Concessional Loan
2	ExIm Bank (China)	Southern transmission lines modernization	JSC NEGK	2011-2013	$208 million	Concessional Loan
3	IDB	Improving power supply of Bishkek and Osh	JSC NEGK	2012-2015	$23.08 million	Loan
4	Turkish Republic	Construction of 110kV HVL and 110kV Substation in "Ak-Ordo" residential area, Bishkek	JSC NEGK	2013-2014	$5 million	Loan
Projects under Consideration						
5	IDB	Improving power supply of Arkin residential area	JSC NEGK	2013-2016	$15 million	Loan

(Source: "IV. Sector development assistance already confirmed or under consideration for 2013-2017", DPCC Energy Sector Working Group Paper, April 15, 2013)

1. <u>500kV Datka-Kemin Transmission Line and 500kV Kemin Substation Project</u>

Construction of a new 500kV transmission line which connects Datka substation in Jalalabad suburban area to a new Kemin substation to be built in Chui Oblast has been implemented. The length of the transmission line is 410km. The purpose of constructing the transmission line is to avoid the risk of disconnection of CAPS by Uzbekistan and Kazakhstan, securing the additional transmission corridor to the northern area. As of April 2013, transmission route selection, selection of the location of Kemin substation, and a series of design works has been completed. The construction works is supposed to be started from 2013, and the term of construction works is 36 months. The contractor is TVEA, a Chinese company. The expected year of operation is 2016. Upon completion of the transmission line, it becomes possible to transmit power from either of the substations. If the supply becomes tight in winter, it can directly transmit power to northern area by stopping export of power to Uzbekistan, and by temporary interruption of supply to CAPS for frequency control. The direct supply without using the long distance transmission via CAPS makes it possible to reduce transmission losses, enabling increase in the supply capacity by approximately 250MW.

2. <u>Southern Transmission Line Modernization Project</u>

This project has been implemented since 2011. The project consists of construction of the new 500/220kV Datka substation, rehabilitation of four 220kV substations (Uzlovaya, Alya, October, and Crystal) for the power supply to both Osh and Batken Oblasts, and construction of 220kV transmission lines (total length is 256.5km). In regard to Datka substation, as of April 2013, construction of the 220kV bus-bar has been completed. 500kV bus bar is under construction. According to the information provided by MEI in February 2013, the project was expected to be completed by the month; however, it is behind schedule. Upon completion of the project, the power supply to the southern area only through domestic transmission system without going through Lochin substation, a part of the power system in Uzbekistan, will be realized.

3. Improving Power Supply of Bishkek and Osh Project

The objectives of this project are to improve power supply to Bishkek region and Osh region by rehabilitating the existing substations by transmission capacity reinforcement. The rehabilitation of 220kV Ala-Archa substation in Chui Oblast is expected to be completed in 2013, and the rehabilitation of three 110kV substations (Kizil-Asker (Chui Oblast), Vostochinaya (Chui Oblast), and Kara-suu (Osh Oblast)) are expected to be completed in 2013-2014.

4. 110kV HVL and 110kV Substation in “Ak-Ordo” Residential Area in Bishkek City Project

This project constitutes capacity expansion by transformer replacement. According to the information provided by MEI, the project was supposed to be finished in 2012; however, according to the interview with JSC NEGK, the construction works actually delays and is expected to be completed in 2013.

5. Improving Power Supply of Arkin Residential Area Project

In Arka region of Batken Oblast, which is located in southern part of Kyrgyz, the power has been supplied through 110kV Hadji Bakirgan substation, a part of Tajikistan’s power system, for years. Kyrgyz plans to construct a new 110kV transmission line and substation, and to rehabilitate the existing Arka substation for the purpose of solving the risk led by depending on the power supply from the neighboring country by making it possible to transmit power from domestic power system (Figure 2-6-1). The construction section of the transmission line starts from a point lying midway between the existing 110kV Samat substation and Batken substation (the exact location is unknown) and ends at 110kV Arka substation. The length of the transmission line is 60km. The expected operation year of the transmission line is 2014. 110kV Razakova substation is planned to be constructed between the junction point and Arka substation. Construction of the substation will start in October 2013 and the operation start year is 2014.

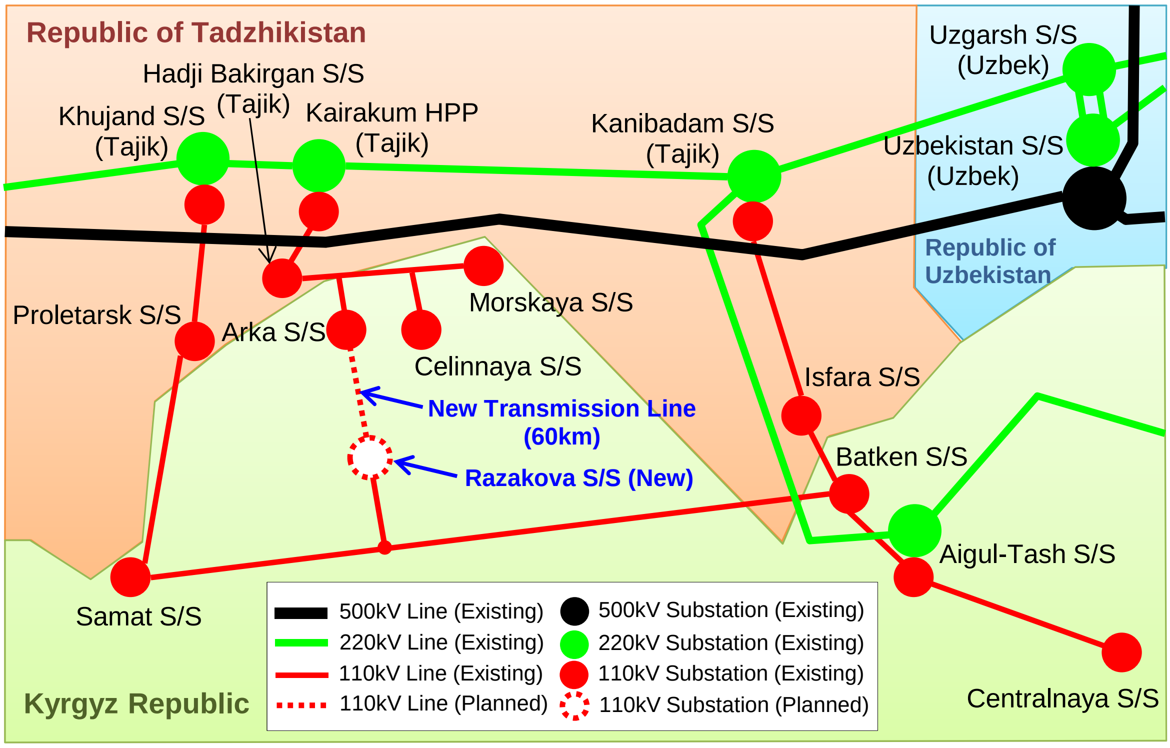


Figure 2-6-1 Project Area of “Improving Power Supply of Arkin Residential Area Project”

6. Other Projects

(1) 500kV Kemin – Almaty Transmission Line Project

This project constitutes construction of a new 500kV transmission line between the new Kemin substation to be built in Chui Oblast and the existing Almaty substation in Kazakhstan. The length of the transmission line is 232.3km. The expected commercial operation year is 2017 or 2018. WB plans to provide financial assistance for the project. As the consultant responsible for the feasibility study, JSC Kazakh Research Institute of Energy im. Akademika Sh. Ch. Chokina has already been selected. Upon completion of the project, the new route for power supply to Bishkek city and Chui Oblast will be added, resulting in completion of a ring-shaped transmission system. Increase in capacity of power trade between Kyrgyz and Kazakhstan is expected with this system.

(2) CASA 1000 Project[20]

The purpose of the project is to supply surplus power (5,000GWh) in summer from Kyrgyz and Tajikistan to both Afghanistan and Pakistan, markets of which are growing rapidly at present because the electricity consumption of both Kyrgyz and Tajikistan is low in summer; conversely, it hits the peak in Afghanistan and Pakistan in the same period. The estimated project budget is USD 1 billion. The project consists of construction of a 500kV AC transmission line from Datka substation in Kyrgyz to Khodgent substation in Tajikistan, and a 500kV HVDC transmission line from Sangtuda hydropower station in Tajikistan to Peshawar, the provincial capital of Khyber Pakhtunkhwa province in Pakistan through Afghanistan, the capital of which is Kabul where the intake point exists. Both Afghanistan and Pakistan expect the year-round power import by the transmission lines, however, ADB decided to withdraw from assistance of the project on the ground that it is not sustainable to implement the scheme due to power supply shortage for Kyrgyz’s domestic use in winter. On the other hand, WB takes the initiative in facilitating the project. As of April 2013, the project was still under negotiation among the countries concerned and the international approach to financing was still on the way.

20 “Final Report on Project Activities of the Kyrgyzstan Energy Advisory Services”, p.88.

2-6-3 Distribution Development Plan

JSC Severelectro, the receiving power of which accounts for approximately 52%[21] of the power flow from JSC NEGK's transmission grid, has expanded capital investment from 283.9 million Som to 611.3 million Som, or 115% increase, from 2010 to 2012. Since 2010, JSC Severelectro has placed importance on replacement of conductors of 35kV overhead distribution lines and cables of underground distribution lines, transformers, and construction of new distribution substations. In addition to these facility reinforcement projects by own funds, a series of projects supported by KfW have been implemented as parts of loss reduction and efficiency improvement projects[22,23] since 2006. These projects consist of replacement of underground cables, replacement of bear conductors by coated conductors for power theft prevention, replacement of old electricity meters by smart meters suitable for distant reading, installation of data acquisition and transmission devises aiming at cutting off the non-payment consumers.
In 2012, JSC Oshelectro, the receiving power of which accounts for approximately 20% of the power flow from JSC NEGK's transmission grid, implemented the following projects for transformer capacity improvement, modernization of 35kV overhead distribution lines, and reliability improvement by its own funds:

- Replacement of transformers of 35kV distribution substations (Osh-1, Osh-3, Osh-4 substations)
- Upgrading of 35/10kV distribution substation to 110kV substation (Rechnaya, Osh-7 substations)
- Rehabilitation of damaged cable connections of 35kV distribution line between Osh-5 substation and Centre II substation, and between Pamirskaya substation and Centre substation)
- Changing the cables to greater diameter

Along with the aforementioned projects, the following projects financed by WB and/or own funds were executed in 2012:

- Construction of Dostuk 35/6-10kV substation
- Installation of transformers allocated by WB upon the "Emergency Assistance Project"
- Construction of 10kV distribution line and installation of 10/0.4kV transformers
- Installation of metering devices including current-limiting circuit breakers for customers who use pre-paid cards
- Installation of control panels in multi-story apartment houses using pre-paid card

The JICA Survey Team was not able to obtain information on the distribution rehabilitation and expansion projects for remaining two distribution companies, Vostokelectro and Jalalabadelectro.

A variety of distribution projects are planned as a part of distribution loss reduction in the power sector, one of the short-term countermeasures against power supply shortage due to delay in power development corresponding to increase in the power demand, as follows:

[Technical Loss Reduction]
- Rehabilitation of dilapidated facilities
- Reinforcement of capacities by replacement of overloaded equipment
- Construction and/or installation of new facilities/equipment

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[21] According to the information by NEGK, power flow from NEGK's grid to distribution companies on the day when maximum load was recorded in 2012 is as follows: Severelectro 1,399MW (51.7%); Oshelectro 528MW (19.5%); Vostokelectro 377MW (13.9%); Jalalabadelectro 401MW (14.8%)
[22] KfW: Loss Reduction in the electricity sector I (Strengthening of the local electricity network Bishkek/Advanced Measures Severelectro)
[23] KfW: Efficiency improvement in electricity distribution

[Commercial Loss Reduction]

- Replacement of old electricity meters by smart meters
- Installation of data acquisition and transmission devices for distant reading
- Replacement of bare conductors by coated conductors for 0.4kV low voltage lines to prevent power theft

Some of the projects have already been implemented with supports of international donors. Donors are likely to support JSC Severelectro's project because they put emphasis on the assistance to the company on the grounds that it is the largest of the four distribution companies, and that it supplies power to about a half of domestic consumers. As to self-financed projects, JSC Severelectro barely has a short-term development plan in several years; however, there was no available information on the mid-term development plan. The person in charge answered that JSC Severelectro was not able to make mid or long-term development plan since the budgets to be allocated by the State Regulation Department had not yet determined. The prospective and ongoing projects of JSC Severelectro for 2013-2017 are summarized in Table 2-6-3.

Table 2-6-3 JSC Severelectro's Distribution Projects supported by Donors

No.	Donor	Name of the Project	Implementing partner/Contractor	Implementation Period	Amount (in original currency)	Budget support/grant/loan/ other
Approved Projects						
1	KfW	Loss Ruduction in the electricity sector I (Strengthening of the local electricity network Bishkek/Advanced Measures Severelectro)	JSC Severelectro	2006-2015	10.23 million Euro 0.2 million Euro	Loan (Investment) Grant (TA/AM)
2	KfW	Efficiency Improvements in Electricity Distribution	JSC Severelectro	2008-2016	21.4 million Euro 1.8 million Euro	Loan (Investment) Grant (TA/AM)
3	World Bank	Emergency Assistance Project	Energy Companies	2010-2013	$35 million	Loan Grant
Projects under Consideration						
4	World Bank	Improving transparency of the energy sector and reducing electric energy losses	JSC Severelectro	2014-2018	Approximately $15 million	Loan Grant

(Source: "IV. Sector development assistance already confirmed or under consideration for 2013-2017", DPCC Energy Sector Working Group Paper, April 15, 2013)

1. <u>Loss Reduction in the Electricity Sector I Project and 2. Efficiency Improvements in Electricity Distribution Project</u>

These are ongoing projects; the former is to be completed in 2015 and the latter in 2016. The projects consist of replacement of underground distribution cables, replacement of old meters by smart meters (110,136 units), development of remote reading and energy accounting system, replacement of bear conductors by coated conductors (0.4kV low voltage lines, 445km). All of these are in the loan portion.

3. <u>Emergency Assistance Project</u>

This is also an ongoing project. In 2012, 550 units of transformers in Osh city, especially the overloaded ones, were replaced. In 2013, additional 550 units of transformers are planned to be replaced. Based on the information by MEI, in Kyrgyz, 5,118 units of transformers need complete replacement. Out of these, replacement of 1,100 units has been financed by WB; however, about 4,000 units of remaining transformers (10/0.4kV and 6/0.4kV) are still waiting for financing. Without support by donors, each distribution companies have to conduct replacement by their own budget.

4. Improving Transparency of the Energy Sector and Reducing Electric Energy Loss Project

WB plans to provide assistance on another distribution loss reduction project targeting at JSC Severelectro. The components of the project are as same as those of abovementioned Loss Reduction in the Electricity Sector I Project and Efficiency Improvements in Electricity Distribution Project supported by KfW, in other words, replacement of bear conductors for low voltage lines to coated conductors, development of automatic data acquisition and electricity accounting system, etc. The project is planned to be implemented in the area which KfW projects doesn’t cover. Along with the components, as the policy-related assistance, it is under consideration that establishment of Settlement Center and Regulation Center, the assistance of which has already been provided since 2012, and compensation of the national budget under the condition of raising electricity tariff to the extent which recovers the cost by the next 5 year plan coming into operation from 2014.

2-7 Power Demand and Supply Planning

2-7-1 Demand Forecast

MEI said that it is estimated that the growth rate of power consumption in the future is to be 3% to 5%, however evidence is not clear.

It is herein described that demand forecasts for the future power consumption are estimated based on the relationships between previous growth rates of GDPs and power consumptions.

The previous transitions of GDPs from 1986 to 2011 and power consumptions from 1995 to 2010 are shown in Figure 2-7-1 and Figure 2-7-2 respectively. Also, the relationship between both of the growth rates is shown in Figure 2-7-3.

According to the Figure 2-7-1 and Figure 2-7-3, the GDP growth rate had a variation repeatedly between 0% and 10%, focusing on 5% as a center point for the past 15 years from 1996 to 2010 after confusion of the Soviet Union collapse in 1991. Also, the growth rate of power consumption is larger fluctuations in the same manner as GDP's. The relationship between the consumption growth rate and the GDP growth rate is not clear, but it is considered that the value of GDP elasticity of power consumption is between 0 and 0.5 taking into consideration of range of the both of variations.

It is assumed that the GDP growth rate of the past 15 years is to be continued as a constant value at 5% in a next coming decade. Based on this assumption, the growth rate of power consumption in the coming decade can be estimated as 0% to 2.5% based on the following calculations;

- ◆ "5% of GDP growth rate × GDP elasticity 0= 0% of the growth rate of power consumption in the coming decade"
- ◆ "5% of GDP growth rate × GDP elasticity 0.5= 2.5% of the growth rate of power consumption in the coming decade"

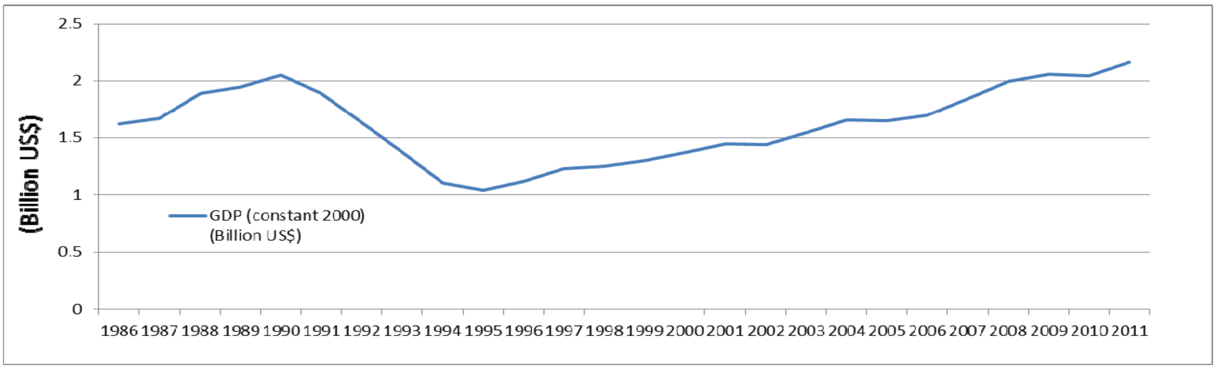
In addition, for estimating maximum peak demands, it is assumed that load factor of 2011 is to be continued as a constant value in a next decade.

As mentioned above, the GDP elasticity of the power consumption in a decade is examined in two cases of the "Real Case: value of elasticity 0" which does not expect the growth of an amount of consumption like the actual for the past 15 years, and the "Base Case: value of elasticity 0.5" which expects future growth of power consumptions.
Therefore, the power consumption growth rates in a coming decade can be calculated as "0% of the Real Case" and "2.5% of Base Case" as mentioned above.

Further, since the MEI assumes 3% to 5% of growth in power consumption, "Optimistic Case at 5.0% (1.0 of GDP elasticity) of consumption growth" is also examined as a reference.

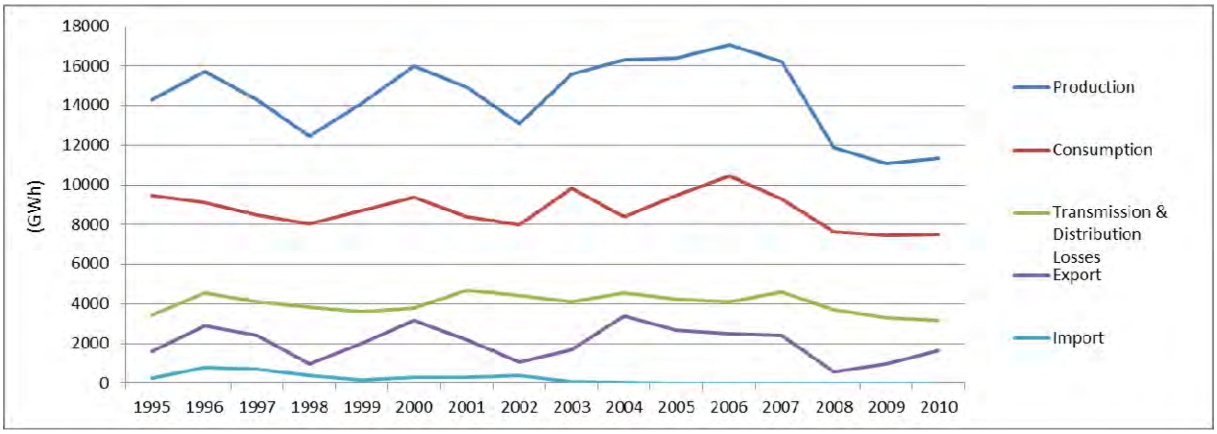
For power consumption growth rate over the next decade, the classifications of the case studies are summarized below.

- ◆ Real Case : 0% power consumption growth rate (0 of GDP elasticity)
- ◆ Base Case : 2.5% power consumption growth rate (0.5 of GDP elasticity)
- ◆ Optimistic Case (as reference) : 5.0% power consumption growth rate (1.0 of GDP elasticity)



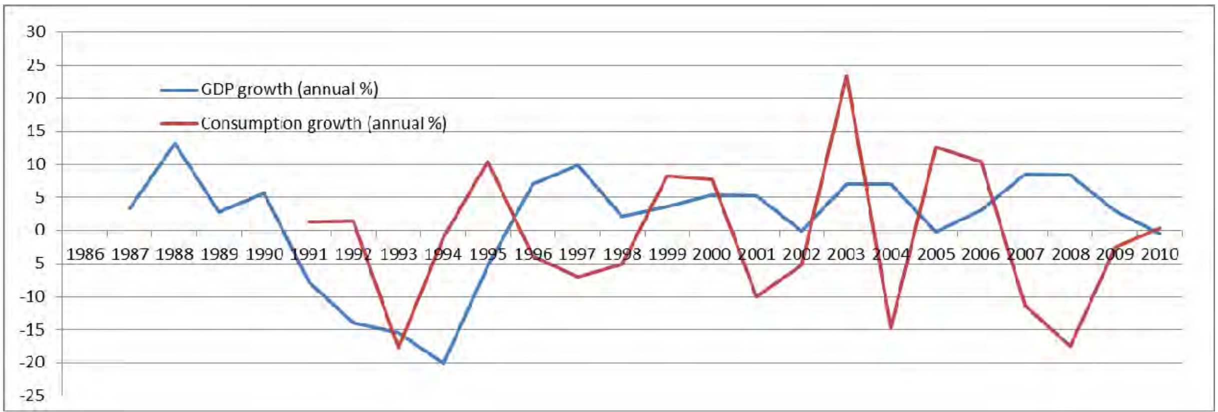
(Source: The World Bank DataBank)

Figure 2-7-1 Transition of GDP



(Source: The World Bank DataBank/ADB Key Indicators 2012)

Figure 2-7-2 Trends of Power Supply and Consumption



(Source: The World Bank DataBank)

Figure 2-7-3 Relationship of Growth Rates between GDP and Power Consumption

2-7-2 Power Demand and Supply Planning

The power demand and supply planning of Kyrgyzstan is examined based upon the following assumptions.

- It is assumed that the maximum peak demand in January 2012 is exceeded at 250 MW of supply performance as described in "2-4-3 Maximum Output and Maximum Peak Load in January 2012".
- Two (2) cases are examined for the maximum peak demand for a decade up to 2023. As described in the "2-7-1 Demand Forecast", the two (2) cases of the maximum peak demand are set as their average growth rate at 0% and 2.5%. Also, 5% of the maximum peak demand growth rate is examined following to the MEI's estimation as reference.
- The commission years for the respective projects are assumed in the basis of the power system development plan described in the section 2-6. Comparing to the plan of the PSDS 2012-2017, many projects are expected to delay based on the latest information.
- Supply capacities of new hydropower plants in winter are assumed as 50% and 100% of installed capacities for run-off-river type and reservoir type respectively.
- According to MEI, it is expected that the completion of 500KV transmission line (Datka-Kemin) would results in increasing equivalent 200MW of outputs during tight supply in winter, i.e., i) cancelation of power exports to Uzbekistan, ii) cancelation of frequency adjustment for the CAPS, and iii) cancelation of losses of the long-distance CAPS transmission.
- It is assumed that system losses for the new power generations and effect of loss reductions are not taken into account in the power supply planning.
- It is assumed that electricity imports to power shortage are not included in the power supply planning.
- Appropriate reserve margin rate (hereinafter, "RMR") of power supply are assumed to be 20%, while RMR in developing countries is 20% to 30% generally.

Based upon the abovementioned assumptions, the power demand and supply plans are summarized in Figures 2-7-4 to 2-7-6 and Tables 2-7-1 to 2-7-3.

Since the power supply is 250MW below the demand of 2012, "minus value" of RMR of 2012 is observed in the results of all cases. This is continued up to the commission of Kambarata-1 (1,900M) which is planned in 2021 in the "Base Case".
It is understood in the "Base Case" that, although the gap between demand and supply is temporarily mitigated by completion of the 500kV transmission line (Datka-Kemin) in 2015, the worst gap of 500MW is occurred in 2020 just before the completion of Kambarata-1 (1,900 MW) in 2021.
In the "Real Case", it is observed that, although RMR come to the "plus value" by completion of the 500kV transmission line (Datka-Kemin) in 2015, it is still below the appropriate RMR of 20% up to the completion of Kambarata-1 (1900 MW) in 2021.

Table 2-7-1 Power Demand and Supply Plan
(Real Case: Peak Demand Growth Rate = 0%)

Year	Predicted Maximum Peak Demand (MW)	Expected Available Capacity (MW)	Required Available Capacity with RMR20% (MW)	Expected Development & Rehabilitation, Based upon PSDS 2012-2017, etc.		Reserve Margine Rate; RMR (%)
				Available Additional Capacity in Winter (MW)	Additional Installed Capacity (MW)	
2012	3,285	3,035	3,942		(Shortfall 250MW in January 2012)	-8%
2013	3,285	3,035	3,942			-8%
2014	3,285	3,035	3,942			-8%
2015	3,285	3,325	3,942	290	500kV T/L Datka-Kemin(additional 200MW)、Kambarata-2#1(120MW, winter additional 30MW) Kambarata-2#2(120MW, winter additional 60MW)	1%
2016	3,285	3,477	3,942	152.2	Bishkek CHPP(400MW, additional 150MW), Small HPPs of Sokuluskaya-5(1.5MW, winter additional 0.7MW), & Tortgulskaya(3MW, winter additional 1.5MW)	6%
2017	3,285	3,482	3,942	4.8	At-Bashiskaya HPP (40MW, winter additional 1MW), Small HPP of Oy-Alma(7.7MW, winter additional 3.8MW)	6%
2018	3,285	3,507	3,942	25	Uch-Kurgan(180MW, winter additional 5MW), Small HPP of Orto-Tokoskaya(20MW, winter 10MW)	7%
2019	3,285	3,507	3,942			7%
2020	3,285	3,507	3,942			7%
2021	3,285	5,622	3,942	2115	Kambarata-1(1900MW), Kambarata-2 (winter addiotoinal 120MW), Upper Naryn(191MW, winter 95MW)	71%
2022	3,285	5,622	3,942			71%
2023	3,285	5,622	3,942			71%

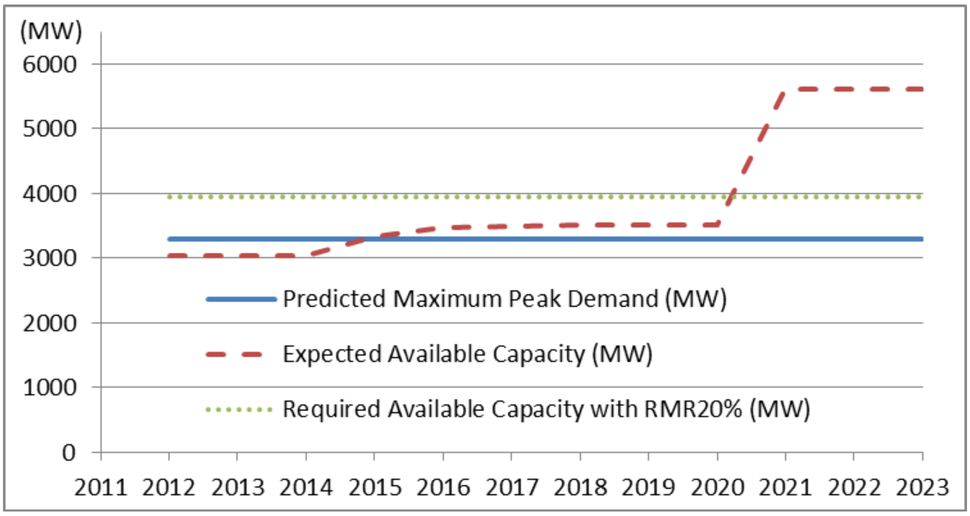


Figure 2-7-4 Power Demand and Supply Plan
(Real Case: Peak Demand Growth Rate = 0%)

Table 2-7-2 Power Demand and Supply Plan
(Base Case: Peak Demand Growth Rate = 2.5%)

Year	Predicted Maximum Peak Demand (MW)	Expected Available Capacity (MW)	Required Available Capacity with RMR20% (MW)	Expected Development & Rehabilitation, Based upon PSDS 2012-2017, etc.		Reserve Margine Rate; RMR (%)
				Available Additional Capacity in Winter (MW)	Additional Installed Capacity (MW)	
2012	3,285	3,035	3,942		(Shortfall 250MW in January 2012)	-8%
2013	3,367	3,035	4,041			-10%
2014	3,451	3,035	4,142			-12%
2015	3,538	3,325	4,245	290	500kV T/L Datka-Kemin(additional 200MW)、Kambarata-2#1(120MW, winter additional 30MW) Kambarata-2#2(120MW, winter additional 60MW)	-6%
2016	3,626	3,477	4,351	152.2	Bishkek CHPP(400MW, additional 150MW), Small HPPs of Sokuluskaya-5(1.5MW, winter additional 0.7MW), & Tortgulskaya(3MW, winter additional 1.5MW)	-4%
2017	3,717	3,482	4,460	4.8	At-Bashiskaya HPP (40MW, winter additional 1MW), Small HPP of Oy-Alma(7.7MW, winter additional 3.8MW)	-6%
2018	3,810	3,507	4,572	25	Uch-Kurgan(180MW, winter additional 5MW), Small HPP of Orto-Tokoskaya(20MW, winter 10MW)	-8%
2019	3,905	3,507	4,686			-10%
2020	4,002	3,507	4,803			-12%
2021	4,103	5,622	4,923	2115	Kambarata-1(1900MW), Kambarata-2 (winter addiotoinal 120MW), Upper Naryn(191MW, winter 95MW)	37%
2022	4,205	5,622	5,046			34%
2023	4,310	5,622	5,172			30%

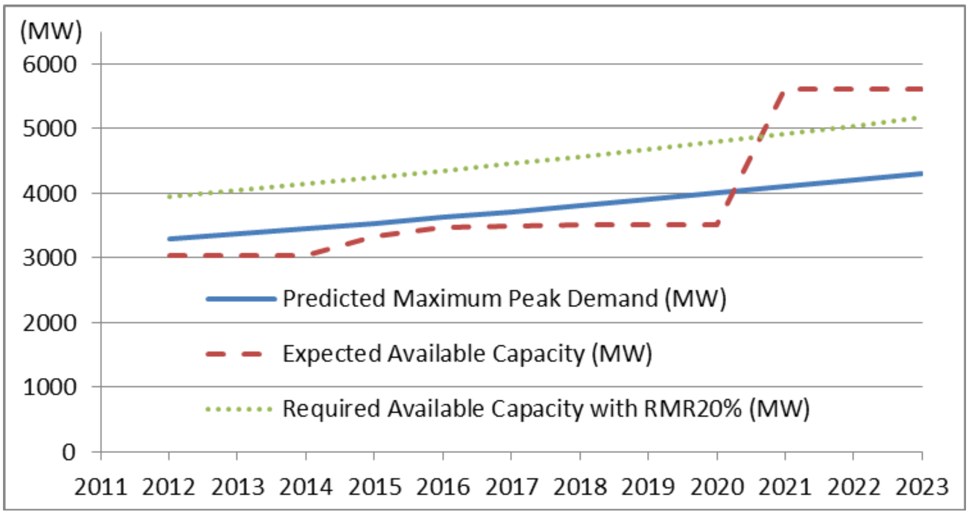


Figure 2-7-5 Power Demand and Supply Plan
(Base Case: Peak Demand Growth Rate = 2.5%)

Table 2-7-3 Power Demand and Supply Plan
(Optimistic Case: Peak Demand Growth Rate = 5.0%)

Year	Predicted Maximum Peak Demand (MW)	Expected Available Capacity (MW)	Required Available Capacity with RMR20% (MW)	Expected Development & Rehabilitation, Based upon PSDS 2012-2017, etc.		Reserve Margine Rate; RMR (%)
				Available Additional Capacity in Winter (MW)	Additional Installed Capacity (MW)	
2012	3,285	3,035	3,942		(Shortfall 250MW in January 2012)	-8%
2013	3,449	3,035	4,139			-12%
2014	3,622	3,035	4,346			-16%
2015	3,803	3,325	4,563	290	500kV T/L Datka-Kemin(additional 200MW)、Kambarata-2#1(120MW, winter additional 30MW) Kambarata-2#2(120MW, winter additional 60MW)	-13%
2016	3,993	3,477	4,792	152.2	Bishkek CHPP(400MW, additional 150MW), Small HPPs of Sokuluskaya-5(1.5MW, winter additional 0.7MW), & Tortgulskaya(3MW, winter additional 1.5MW)	-13%
2017	4,193	3,482	5,031	4.8	At-Bashiskaya HPP (40MW, winter additional 1MW), Small HPP of Oy-Alma(7.7MW, winter additional 3.8MW)	-17%
2018	4,402	3,507	5,283	25	Uch-Kurgan(180MW, winter additional 5MW), Small HPP of Orto-Tokoskaya(20MW, winter 10MW)	-20%
2019	4,622	3,507	5,547			-24%
2020	4,853	3,507	5,824			-28%
2021	5,096	5,622	6,115	2115	Kambarata-1(1900MW), Kambarata-2 (winter addiotoinal 120MW), Upper Naryn(191MW, winter 95MW)	10%
2022	5,351	5,622	6,421			5%
2023	5,618	5,622	6,742			0%

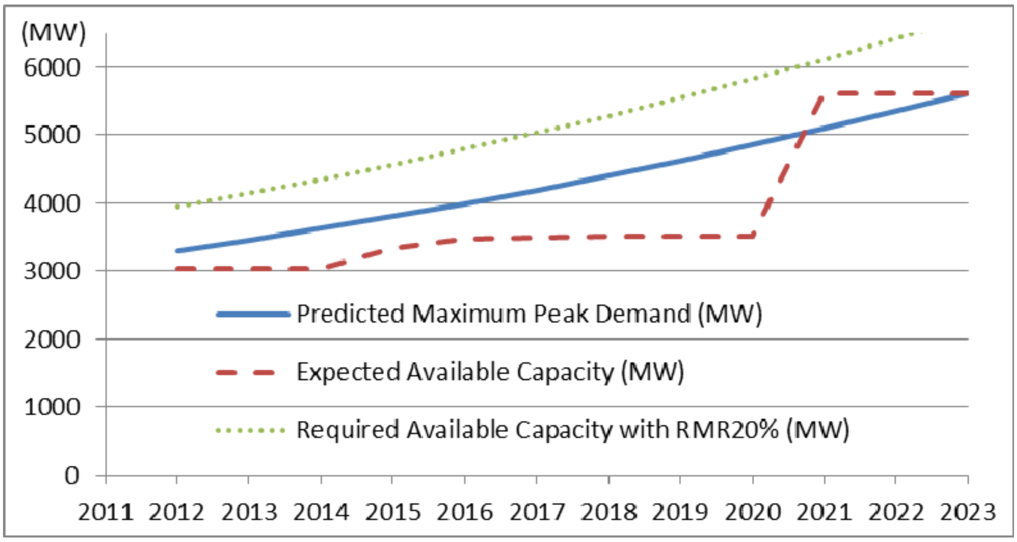


Figure 2-7-6 Power Demand and Supply Plan
(Optimistic Case: Peak Demand Growth Rate = 5.0%)

2-8 Issues and Policy Approaches in the Power Sector

As policies of the government, the power sector aims to firstly obtain stable power supply to the country, and finally earn foreign currency by exporting electricity to the neighboring countries, focusing upon management improvement of the power sector and also development for sustainable and efficient operation of the power system. Based upon the abovementioned policies, the government has issued the power sector development strategy up to 2017 in the Governmental Decree N330 in May 2012 on “the medium-term strategy of power energy development over the period 2012-2017”.

There are however a lot of problems and issues in the power sector currently to be solved for obtaining the stable power supply. The ideal concept for overcoming those problems and issues can be imaged in Figure 2-8-1. As shown herein, the following activities and efforts should be executed immediately as well as concurrently and in parallel by the government initiatives, because policy approaches for overcoming those problems and issues has a very deep interrelated.

- ◆ Implementation of precise rehabilitation and renovation works in order to continue the effective operation of the existing aging power system
- ◆ Development of new power plants and networks immediately
- ◆ Tariff increase for collecting sufficient funds as well as for energy saving
- ◆ Achievement of efficiency improvement of operations such as distribution loss reductions and others with ensuring the transparency and accountability so as to obtain public understanding necessary to raise the tariffs

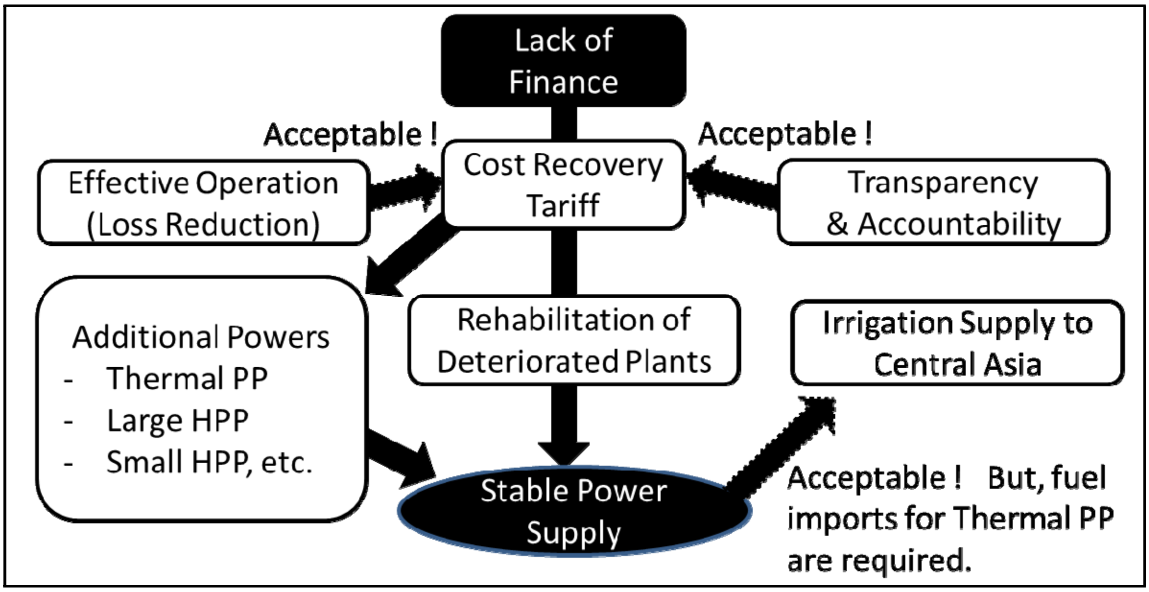


Figure 2-8-1 Ideal Concept for Stable Power Supply

1. <u>Insufficient power supply for the winter demand</u>

◆ Problems and Issues

Though the planned power outage was carried out, the 3,035 MW highest supply output was recorded in January 2012. The planned outages of approximately 200MW and 50MW were performed in the northern and the southern regions respectively. Taking into consideration of the highest supply output 3,035MW and the total outage of 250MW in the whole country as abovementioned, the assumption value of the maximum demand is estimated to be 3,285 MW in the country.
A reserve margin rate (RMR) of power supply capacity is calculated as -8% as of January 2012, although approximately 20% of RMR is generally needed for the suitable power system operations. It is estimated that the critical situation of gap between the electric power demand and supply will be

continued up to completion of the large-scale hydropower developments of Kambarata-2 (1,900MW) and Upper Naryn Cascade (191MW) in 2021.

◆ Policy Approaches

In order to mitigate the gap between demand and supply before 2021, MEI is implementing and/or planning the following short-term countermeasures.

- For the purpose of operating the independent power network system from the CAPS in Central Asia at the time of an electric power shortage during the winter, the 500kV transmission line between Datka and Kemin is under construction with support of China.
- Aiming to a numerous of developments of small-scale HPPs immediately, the mechanism of the feed-in tariffs has been already introduced in 2008 with support of UNDP, for accelerating private sector participations upon the renewable energy development.
- Some of distribution loss reduction projects have been implemented with supports of KfW and WB
- For the purpose of securing current power supply as well as expecting an increase of power output, some of rehabilitation and renovation works for existing power plants are under processing with supports of SECO, ADB, etc.
- With the effect of energy saving by consumers and suppression of the power demand increase, the new tariff mechanism is under consideration with support of USAID and WB

2. <u>Aging Power Plants</u>

◆ Problems and Issues

There are totally 3,786 MW of installed capacity in Kyrgyzstan. More than 90% thereof were developed 30 to 50 years or more ago except for two (2) power plants of Shamaldy-Sai HPP (240MW, 1994) and Kambarata-2 HPP (120MW, 2010). Therefore, it is necessary to carry out suitable rehabilitation and renovation works for some of such aging power plants, and to secure electric supply reliability.

◆ Policy Approaches

Rehabilitation for At-Bashi HPP (40MW, 1970) is to be supported by SECO (Switzerland). Also, repair works for Toktogul HPP (1,200MW, 1975) have been done in part with supports of ADB. Furthermore, the source of funds is under adjustment for rehabilitation and renovation works of Bishkek central heating PP (666MW, 1961) and Uchkurgan HPP (180MW, 1961).

3. <u>Tariff structure that does not reach the full cost recovery level</u>

◆ Problems and Issues

A weighted average of electricity tariffs in 2013 is planed to be 0.879Som/kWh by MEI, but it is only for charges of minimum labor costs, etc. and not for charge of appropriate operation costs for the power entities, which is not reached to the full cost recovery level. A weighted average tariff of the full cost recovery level is calculated as 1.243Som/kWh by the MEI. Therefore, it can be considered that some tariff hikes of approximately 40% against the current average rate 0.879Som/kWh are required.

◆ Policy Approaches

While the support for the human resource development by USAID aims at the introduction of the full cost recovery level of tariffs, MEI is preparing a medium-term electricity tariff policy such as tariff hike of twice a year in five years from 2014. Based on the abovementioned tariff hike, it is expected that improvement of the financial situation of the power entities with healthy operations by appropriate repair cost acquisition can be achieved. Also energy saving by consumers can be expected because of the tariff hike, which will result in the effect of suppression of the power demand increase.
In addition, some ideas of the cross-subsidy tariff structure are also under consideration by the government for supplying power to the poor.

4. <u>High Level of Distribution Losses</u>

◆ Problems and Issues

As shown in Figure 2-8-2, distribution loss exhibits a high loss rate continuously as a whole. The main reasons are commercial losses such as metering tampering and power theft as well as technical losses due to aging of distribution facilities. The distribution loss reductions can be considered as one of short term countermeasures to mitigate power shortage due to insufficient power developments. Therefore, the prompt reduction of distribution losses is extremely important.

◆ Policy Approaches

DFR under the organization of MEI has made the agreement of an annual Performance Agreement with distribution companies since 2011 in order to monitor the achievement of target indicators such as the recovery of account receivable, loss reduction and the like.

The distribution companies has been implementing and/or planning the following activities as the specific measures of distribution loss reductions.

- ➢ Measures to reduce technical losses
  - ・ Renovating of aging distribution facilities
  - ・ Increasing the capacity of the overload distribution facilities
  - ・ Developing new distribution facilities
- ➢ Measures to reduce commercial losses
  - ・ Exchanging to the smart metering system from the older power metering system
  - ・ Introducing automatic meter reading system with the development of data transmission for communication systems
  - ・ Covering 0.4kV low pressure line for the purpose of prevention of power theft

In addition, some projects have been already implemented by the supports of KfW and WB.

Moreover, it is under examination by the government for four (4) distribution companies to be merged with one company, aiming to the country wide simultaneous developments of efficient distribution operations introducing appropriate loss reduction measures.

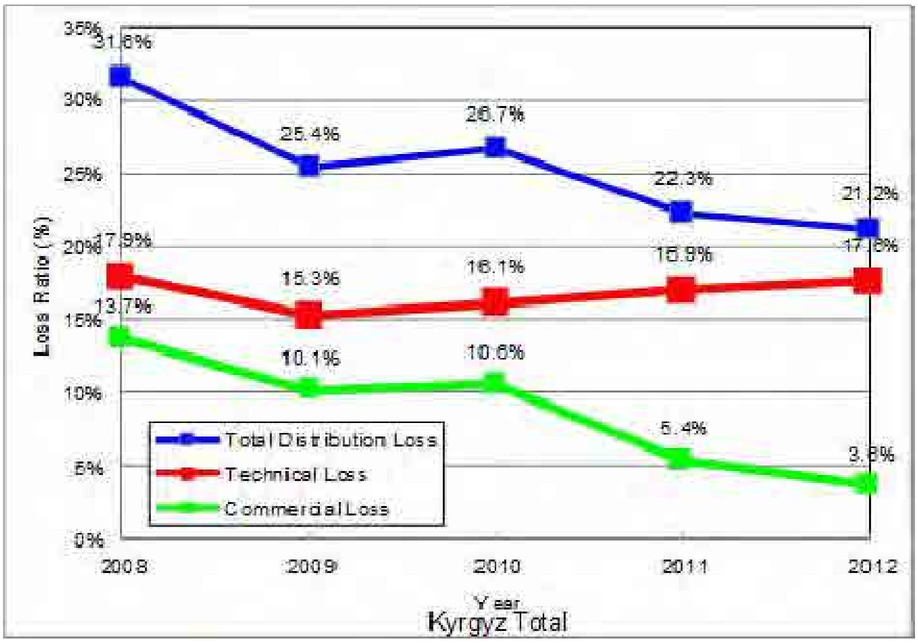


Figure 2-8-2 Transition of Distribution Losses over the past five years

5. <u>The Constraints for Water Management in Central Asia</u>

◆ Problems and issues

The water management of Toktogul reservoir including operation of the power plant is constrained by the government agreements for supplying the irrigation water in Central Asia.

Occasionally in January 2012, a sufficient amount of water had accumulated in the Toktogul reservoir, and therefore Toktogul HPP and the four (4) HPPs in the downstream can be fully operated only for the short period of time to the peak demand. On the other hand, in 2008 to 2010 when it was affected by the drought years of 2008 and 2009, there was not sufficient water in Toktogul reservoir for operating the power plants in winter due to the agreements.

It is therefore understood that one of the issues on the operation of HPPs is the constraint of irrigation water management for the Central Asia. Also, there is an issue for stable operations of the power system that Toktogul HPP and the downstream four (4) HPPs have approximately 90% of all domestic power supply.

◆ Policy Approaches

MEI plans the construction of new reservoir of 4.7 bil. m^3 for Kambarata-1 HPP (1,900MW, 2021) in the upstream of Toktogul reservoir of 19.5 bil. m^3 which is the largest in the Central Asia.

It is expected that development of Kambarata-1 reservoir plays an important role not only for adding power supply outputs but also for supplying irrigation water to the Central Asia easily even in winter.

6. <u>Transparency of Accounting Management System</u>

◆ Problems and issues

In the power sector, with the aim to achieve transparency with respect to the flow of money sending from consumers to the power entities, the escrow accounting system has been introduced since 2011 that a third party, i.e., a bank, is to be collecting bills from consumers and paying it to the power entities. However, DFR under the organization of MEI has an authority to determine the amount of paying to the power entities taking into account of income and expenditure of the companies. The amounts are decided in every year on monthly basis by DFR at the level of minimum expenditures of the power entities such as labor cost and minimum operation costs.

Profits and losses may be disappeared in this mechanism not to rely upon efforts of the power entities.

Furthermore, if the power entities got the profit, there is a mechanism to pay to SPF of a stock dividend of 30% and corporate tax of 16% thereof. However, the stock dividend of fact is different in each case. There are some cases in which the power entities paid dividends 70% of the profit. The flows of un-transparency money still remain in the power sector.

◆ Policy Approaches

To response for the un-transparency account system as mentioned above, the government is now preparing reorganization of the power sector as described below.

- Instead of DFR, the independent organization "Settlement Center" is to be newly founded for aiming at transparency account managements in the power sector in the structure of the introduced escrow account system.
- Also, instead of DFR, independent “Regulation Center” is to be newly established for the managements of tariff system, regulation, licensing and the like.
- Furthermore, though SPF currently owns the power entities such as JSC EPP, JSC NEGK and JSC DisCos, it is under examination by the government that it transfers to MEI’s ownership and consequently MEI can manage whole power facilities more efficiently as an owner.

For the abovementioned preparations by the government, WB has provided the support of maximum USD 30mil. every year to the national budget for three years since 2012.

2-9 Donors' Activities for the Power Sector

Focusing upon projects to be completed before 2021 of commission of Kambarata-1 (1,900MW), donors' short-term activities for mitigating power gap before 2021 are described herein, as well as summarized in Table 2-9-1.

2-9-1 ADB's Activities

As support for power generation, rehabilitation of Toktogul HPP (1,200MW, 1975) is being implemented by ADB. For the ongoing phase-1 project from 2012, the USD 55mil. was allocated as grant and loan by ADB to rehabilitate the runner, governor, switch, etc.. It is scheduled to be completed in 2016, while it takes longer time for the completion because continuous operation shall be kept and required for the stable power supply. For phase-2 project planned from 2015 up to 2017, there are possibilities with assistance of USD 140-160mil, in which total replacements of water turbine, generator for unit 2 (300MW) and unit 4 (300MW) are to be implemented. In general, increasing the output of 10% to 20% of existing capacity (600MW) is expected as 100MW or so by rehabilitation of an aging large-scale HPP. Then, for phase-3, there is the concept of rehabilitation of unit 1 (300MW) and unit 3 (300MW) in future.

As support for power transmission, the ongoing projects have been executed for replacement of the SCADA system and meters of Chui Oblast since 2010, and are scheduled to be completed in 2016 by the assistance of USD 45mil. of grant and loan.

As support for distribution, based on the government request, ADB is ready to implement the support of USD 15-20mil. on management improvement and update of various aging equipment for the loss reduction. However, ADB set some conditionality such as transparency of the power sector, re-bundling of four (4) distribution companies and the like against the abovementioned implementations. The projects have not yet been implemented due to the conditionality.

From the above, the short-term outputs before 2021 based on the ADB activities can be expected as;

- ◆ Ensuring the existing supply capacity of Toktogul HPP (1,200MW) by the rehabilitation of phase-1 and phase-2
- ◆ Expecting increased output of 100MW by phase-2 rehabilitation of Toktogul HPP (1,200MW)
- ◆ Reducing transmission losses in Chui Oblast

2-9-2 WB's Activities

For assistance with power generation, a boiler rehabilitation of Bishkek central heating PP is considered aiming for completion in 2015-2016 around by USD 15-20mil.. It is noted that, according to JSC EPP, the total renovation works of Bishkek central heating PP have already been requested to the Chinese government for assistance of USD 300mil.'s loan, for which any answer has not yet been replied by the Chinese government.

For assistance with distribution, the loss reduction project is planned from July 2014 for JSC Severoelectro in which there is a demand for approximately half of the country. The content of this assistance is a covering of the low-pressure line and automations of meter reading as well as tariff collection for power theft prevention. These are the same as the support of KfW and therefore the implementation areas are selected by WB in areas where kfW has not yet covered so far.

For assistance with policy-related, subject to the launch of "Regulation Center" and "Settlement Center" and the tariff hike up to the cost recovery levels, maximum USD 30mil. per year has been compensated to the national budget since 2012.

From the above, the short-term outputs before 2021 based on the WB activities can be expected as;

- Ensuring the existing supply capacity of Bishkek central heating PP by the rehabilitation thereof
- Expecting increased output by rehabilitation of Bishkek central heating PP
- Reducing distribution losses of JSC Severoelectro
- Expecting energy saving and reduction of peak load due to tariff hikes

2-9-3 Other Donors' Activities

USAID has been leading the reform and policy developments for the power sector, and has done to ensure transparency, efficiency improvement, the support of the electricity tariff increase, etc.. As support with short-term effects for the power shortage before 2021, the human resource developments to DFR staffs are being implemented for the know-how for increasing tariffs for the purpose of establishment of 5-year tariff increasing plan from 2014. Due to the tariff hikes, it is expected that energy saving and reduction of peak load may occur.

,

KfW has been continuously implementing the projects of distribution loss reduction and efficiency improvement since 2008, and is scheduled to be continued until 2016 at approximately EURO23mil.. From 2014, WB is willing to start an assistance of the distribution loss reduction collaborating with KfW. As support with short-term effects for the power shortage before 2021, distribution loss reduction can be expected.

At-Bashi HPP (1970, 40MW) will be rehabilitated from 2013 up to 2017 with the support of CHF14mil. from SECO (Switzerland). As support with short-term effects for the power shortage before 2021, increasing some output capacities can be expected by the rehabilitation of the aging HPP.

Table 2-9-1 Recent Donors' Assistance for the Power Sector

Donor	Name of the project	Implementing partner/ Contractor	Implementation period	Amount (in original currency)	Budget support/ grant/loan/other (please specify)	Any other info
SECO	At-Bashi HPP Rehabilitation Project	Has not been procured yet	2013 - 2017	CHF24mil. (Swiss contribution/ CHF19mil.)	Grant	The Draft Agreement is in with the GoK
KfW	Loss Reduction in the electricity sector I (Strengthening of the local electricity network Bishkek /Advanced Measures Severelectro)	Severelectro	2006-2015	Euro10.23mil. Euro 0.2mil.	Loan (Investment) Grant (TA/AM)	
KfW	Efficiency improvements in electricity distribution	Severelectro	2008-2016	Euro 21.4mil. Euro 1.8mil.	Loan (Investment) Grant (TA/AM)	
Eurasian Development Bank	JSC "Electrical Stations" heating season preparation project	JSC "Electrical Stations"	2013-2015	USD 30mil.	Loan	Eurasian Development Bank
ADB	Power Sector Improvement project	JSC NEGK	2010-2016	USD 45mil.	Loan Grant	
ADB	Power Sector Rehabilitation Project	JSC "Electrical Stations"	2012-2016	USD 55mil.	Loan Grant	

(Source: DPCC Energy Sector Working Group Paper, April 15, 2013)

Chapter 3 Current Status of Small Hydropower Developments

3-1 Organizational Framework

Basically, the governmental organizational structure for the development of small HPPs corresponds with the organizational structure for the entire power sector shown in the Chapter 2. As a competent authority, Ministry of Energy and Industry has formulated relevant policies. Figure 3-1-1 focuses on the governmental organizational structure for development of small HPPs. KSTC, a subordinate organization of MEI is a scientific research institute. KSTC has conducted basic studies for small HPP's sites and has surveyed the current conditions of abolished small HPPs. National Science Academy (hereinafter referred to as "Academy") is an organization under the direct control of the government. Academy has researched water resources concerning hydropower and has prepared duration data. Directorate for the Small and Medium Scale Power Generation Projects (hereinafter referred to as "Directorate") is also an organization under the direct control of the government. Directorate is the organization to attract investors for the development of small HPPs.

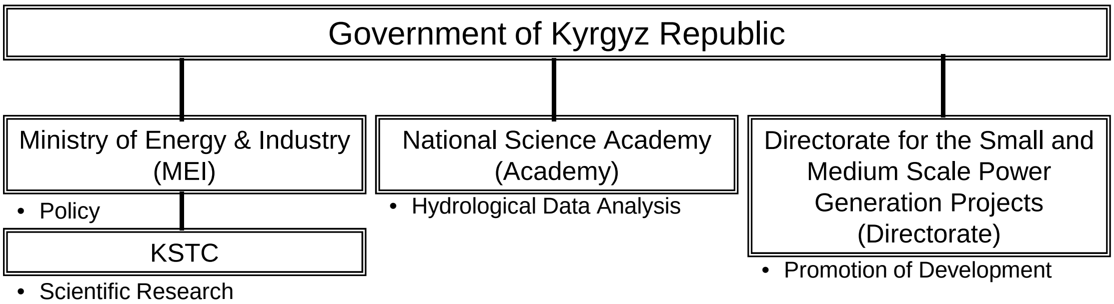


Figure 3-1-1 Governmental Organizational Structure for Development of Small HPP

Most small HPPs were constructed during the Soviet era and decommissioned in the 1970s when large-scale HPPs such as Toktogul HPP were planned and some of them were constructed in fact. Of small HPPs in operation, nine numbers of small HPPs located near the capital Bishkek are owned and operated by JSC Chakan GES. JSC Chakan GES was privatized once in 2005, but was re-nationalized after the revolution that happened in 2010.

As shown in Figure 3-1-2, JSC Chakan GES sells electricity to the Distribution Company, industrial customers and neighbor county, Kazakhstan. The selling price to the Distribution Company and industrial customers is determined by the government, but the selling price to Kazakhstan is determined in the direct negotiation between JSC Chakan GES and Kazakhstan. In addition, a few private companies has entered the small HPP's business and one of them is selling electricity to industrial customers through distribution line owned by a distribution company.

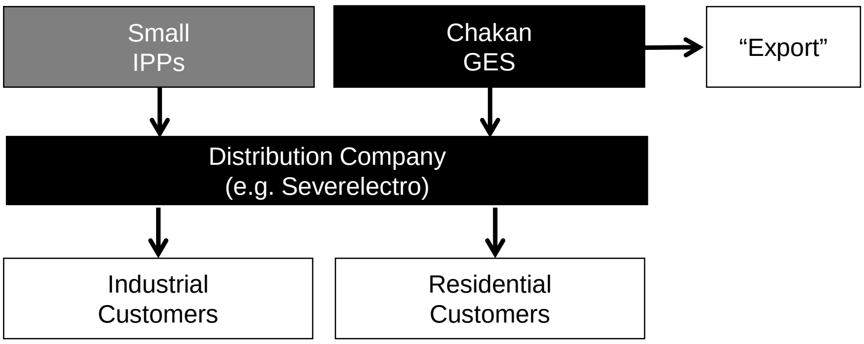


Figure 3-1-2 Flow of Electricity from Small Hydropower Producers to Customers

3-2 Legal System

The government enacted the Renewable Energy Law (N283) in December 2008 to utilize renewable energy for promoting power diversification and energy security as well as environmental protection. In the Law, a mechanism of the "feed-in tariffs" that promise expensive purchase of renewable energies was established in order for the private sector to promote developments of new renewable energies such as small and medium-sized hydropower of 30MW or less, solar power, wind power, biomass power generations, etc..

After enacting the Law in December 2008 (N283) as mentioned above, the Law has been amended in November 2011 (N167), August 2012 (N148) and December 2012 (N170). Based upon the Renewable Energy Law of the latest (N170), overviews of the mechanism of feed-in tariffs are summarized as follows.

1. In the mechanism of the "feed-in tariffs", expensive purchase of renewable energies can be promised for power producers in order to promote the private sector participation upon developments of new renewable energies, i.e., small and medium-sized hydropower of 30MW or less, solar power, wind power, biomass power generation, etc.. It is herein noted that not only the private sector but also government agencies such as Chakan GES can become also power producers in the mechanism. It is however added that not rehabilitation projects but newly developed projects can be included therein.
2. Renewable energy power producers can sell not partial but whole amount of the power generation throughout the year to the state-owned distribution companies that have jurisdiction over separate region of the country. In other words, even in the summer having excess power supplies, the state-owned distribution companies shall purchase the whole amount of renewable energies, generated by the power producers.
3. Purchase rate of the state-owned distribution companies is fixed as multiplication between “the electricity tariff for the highest category” and “2.1 times multiplier”. Based on the current tariff system enacted in April 2010, multiplying “1.50Som/kWh electricity tariff” to industrial, agriculture and other government facilities (tax included) by “2.1 times multiplier” gives the fixed rate “3.15Som/kWh” as purchase rate of the distribution companies in the mechanism of the "feed-in tariffs".
4. A contractual period of the “feed-in tariffs" shall be equal to or less than 8 years in accordance with the Law, for which the government will determine concrete contractual period taking into account of the profitability of the respective project.
5. Purchase rate after the period of 8 years will be set in due course based upon the government consideration of the proper operating costs and the profitability of the respective project.
6. A power producer of renewable energy projects shall bear a capital investment for construction of the interconnection lines from the project site to existing 35kV distribution lines at his own expense.
7. A power producer of renewable energy projects shall obtain a license for development and operation based on the Energy Law (1996). It is however noted that, in case of self-generation and self-consumption, the abovementioned licenses are not required.
8. With respect to imports of equipment associated with the power plant construction of renewable energies, a power producer is exempt from customs duties.
9. Surcharge of the “feed-in tariffs” paid by the distribution companies to power producers shall be compensated to the distribution companies by the government.
10. Regarding international projects implemented by the international institutions as well as donors such as Japan Grant Aid Project, agreements between the both governments shall be separately required to determine the appropriateness and content of the “feed-in tariffs”.

According to MEI, if the mismatch with the legal system is found in the individual each project, MEI is ready to amend the legal system immediately in order for the early introduction of renewable energy development in the ongoing power shortage.

3-3 Current Status of Developments of Small Hydropower Plants

3-3-1 History of Developments of Small Hydropower Plants

In Kyrgyzstan, a lot of small HPPs were constructed in the 1950s and the 1960s, the Soviet era and most of them were decommissioned in the 1970s when large-scale HPPs such as Toktogul HPP were planned and some of them were commissioned. However, as mentioned above, from the situation that prompt enhancement of the power generation capacity by large-scale HPPs is difficult, the development of small HPPs is being taking the spotlight in recent years for the purposes of measurement to aged large-scale HPPs and disparity reduction between urban and rural areas.

The lists of abolished small HPPs obtained from KSTC are shown in Table 3-3-1 to Table 3-3-6. There are 161 plants (total capacity: 44.1 MW) in Kyrgyzstan. Looking at each area, there are 43 plants (9.3 MW) in Chui Oblast, 37 plants (7.8 MW) in Issyk Kul Oblast, 10 plants (2.8 MW) in Naryn Oblast (2.8 MW), 10 plants (3.6 MW) in Talas Oblast, 41 plants (13.7 MW) in Osh Oblast and Batken Oblast, and 20 plants (7.0 MW) in Jalal-Abad Oblast.

Table 3-3-1 List of Abolished Small HPPs in Chui Oblast

No	Name of plant	Capacity (MW)	Year of startup, design	Location of SHPP, name of water course
1	Kaindy	0.041	1949	Kemin region, Kainda river
2	Beisheke	0.384	1954	Kemin region, Chu river
3	Tar-Suu	0.015	1946	Kemin region, Kara-Suu river
4	Tort Kul	0.092	1955	Kemin region, Chon-Kemin river
5	Chim Korgon	0.102	1949	Kemin region, Chu river, "Azyk" channel
6	Ak Tyuz	0.100	1960	Kemin region, Kichi-Kemin r.
7	Buruldai	0.050	1950	Kemin region, Kichi-Kemin r.
8	Kum Aryk	0.036	1955	Panfilov region, Dzharly-Kaindy r.
9	Zharly Kaindy	0.240	1956	Panfilov region, Dzharly-Kaindy r.
10	Tel'man	0.026	1946	Panfilov region, Cholok-Kaindy r.
11	Bukara Station	0.048	1955	Panfilov region, Chon-Kaindy r.
12	Kurpul'dok	0.009	1955	Panfilov region, Kara-Suu r.
13	Chaldovar	0.030	1955	Panfilov region, Kaindy r.
14	For line of CK	0.012	1955	Panfilov region, pond
15	Kara Balta	0.232	1940	Dzhaiyl region, Kara-Balta r.
16	Ak Suu I	0.200	1941	Dzhaiyl region, Ak-Suu r.
17	Ak Suu II	1.400	1964	Dzhaiyl region, Ak-Suu r.
18	Kyzyl Dzhyldyz	0.009	1948	Dzhaiyl region, Kara-Su r.
19	Makachi I	0.043	1940	Dzhaiyl region, Makachi r.
20	Makachi II	0.040	1954	Dzhaiyl region, Makachi r.
21	Sokuluk	0.087	1939	Sokuluk region, Sokuluk r.
22	Sokuluk 1	0.820	1960	Sokuluk region, Sokuluk r.
23	Sokuluk 2	1.160	1962	Sokuluk region, Sokuluk r.
24	Nizhne Chuiskaya	0.060	1950	Sokuluk region, At-Bashinskii R-8
25	Chon Kurchak	0.009	1945	Alamudunskii region, Chon-Kurchak r.
26	Kirgiziya	0.185	1949	Alamudunskii region, Klyuchi r.
27	Vorontsovka	0.100	1954	Alamudunskii region, Klyuchi r.
28	Chuiskaya	0.180	1949	Alamudunskii region, At-Bashinskii
29	Alamedin (sovhoz)	0.060	1955	Alamudunskii region, Alamedin r.
30	Koitash	0.012	1946	Alamudunskii region, Alamedin r.

31	Gornyi Alamedin	1.153	N/A	Alamudunskii region, Alamedin r.
32	Shevchenko	0.068	1951	Issyk-Ata region, Norus r.
33	Milyanfan	0.065	1944	Issyk-Ata region, Chu r., Dungan Aryk
34	Norus	0.160	1955	Issyk-Ata region, Norus r.
35	Issyk Ata	0.087	1939	Issyk-Ata region, Isyk-Ata r.
36	Issyk Ata II	1.444	1957	Issyk-Ata region, Isyk-Ata r.
37	Dmitrievka	0.094	1953	Issyk-Ata region, Isyk-Ata r.
38	Kenesh	0.088	1956	Issyk-Ata region, Kara-Suu r.
39	Kenesh II	0.052	1948	Issyk-Ata region, Kara-Suu r.
40	Ivanovka	0.065	1948	Issyk-Ata region, Krasnaya r.
41	Krasnaya	0.091	1952	Chu region, Krasnaya r.
42	Shamsi	0.058	1939	Chu region, Shamsi r.
43	Kairma	0.057	1948	Chu region, Shamsi r.

Table 3-3-2 List of Abolished Small HPPs in Issyk Kul Oblast

No	Name of plant	Capacity (MW)	Year of startup, design	Location of SHPP, name of water course
1	Arashan	1.577	1963	Ak-Sui region, Arashan r.
2	Teploklyuchenka	0.057	1939	Ak-Sui region, Arashan r.
3	Chon Dzherge Suu	0.182	1953	Ak-Sui region
4	Buzuchuk	0.155	1951	Ak-Sui region, Buzuchuk r.
5	Turgen'	0.052	1941	Ak-Sui region, Turgen' r.
6	Przheval'skaya	0.680	1955	Ak-Sui region, Karakol r.
7	Minprodtov GES	0.080	1955	Ak-Sui region, Karakol r.
8	Irdyk	0.044	1941	Dzheti Oguz region, Ardyk r.
9	Bogatyrovka	0.036	1942	Dzheti Oguz region
10	Dzhety Oguz	0.148	1949	Dzheti Oguz region, Dzheti Oguz r.
11	Barskaun I	0.127	1950	Dzheti Oguz region, Barskaun r.
12	Barskaun II	0.284	1951	Dzheti Oguz region, Barskaun r.
13	Kichi Dzhargylchak	0.060	1949	Dzheti Oguz region, Kichi-Dzhargylchak r.
14	Pokrovka	0.240	1949	Dzheti Oguz region, Chon-Kyzyl-Suu r.
15	Sary Darhany	0.640	1957	Dzheti Oguz region, Dzhuuka r.
16	Zauka (Dzhuka)	0.640	N/A	Dzheti Oguz region, Dzhuuka r.
17	Dzhety Oguz (MTS)	0.024	1945	Dzheti Oguz region, Dzheti Oguz r.
18	Ichke Suu	0.160	1957	Tyup region, Ichke-Suu r.
19	Taldy Suu	0.052	1951	Tyup region
20	Korumdy	0.012	1951	Tyup region
21	Sary-Tolgogoi	0.360	N/A	Tyup region
22	Kuturga	0.046	1942	Tyup region
23	Tyup	0.115	1950	Tyup region
24	Krasnyi Oktyabr'	0.019	1946	Tyup region
25	Chon Oryukty	0.203	N/A	Tyup region
26	Kapchygai	0.144	N/A	Ton region
27	Ton-Karasu	0.142	1949	Ton region
28	Dolinka	0.224	1954	Issyk-Kul region
29	Cholpon-Ata	0.064	1950	Issyk-Kul region
30	Chon-Syugety	0.160	1955	Issyk-Kul region
31	Grigor'evka	0.084	1942	Issyk-Kul region
32	Chet Baisorun	0.096	1939	Issyk-Kul region
33	Chon Baisorun	0.030	1952	Issyk-Kul region

34	Ulahol	0.144	1955	Ton region
35	Orto-Irisu	0.200	N/A	Ton region
36	Chon-Koisu	0.275	N/A	Ton region
37	Orto-Koisu	0.200	1955	Ton region

Table 3-3-3 List of Abolished Small HPPs in Naryn Oblast

No	Name of plant	Capacity (MW)	Year of startup, design	Location of SHPP, name of water course
1	Kochkor	0.310	1957	Kochkor region, Kochkor r.
2	Cholpon	0.131	1955	Dzhumgal region, Kyzart r.
3	Dzhumgal	0.405	1954	Dzhumgal region, Dzhumgal r.
4	Ak-Tala	0.085	1953	Ak-Tala region
5	On-Archa	1.380	1963	Tyan-Shan' region, On-Archa r.
6	Min-Bulak	0.040	1953	Tyan-Shan' region
7	Ak-Dzhar	0.078	1940	Tyan-Shan' region
8	Kara-Suu	0.081	1952	Tyan-Shan' region
9	Besh-Kaindy	0.192	1953	At-Basha region, At-Bashi r.
10	Kulanak	0.048	1939	Ak-Tala region

Table 3-3-4 List of Abolished Small HPPs in Talas Oblast

No	Name of plant	Capacity (MW)	Year of startup, design	Location of SHPP, name of water course
1	Groznenskaya	0.183	1955	Kara-Buura region, Assa r.
2	Kok Sai	0.400	1956	Kara-Buura region
3	Leninpol'skaya-1	1.156	N/A	Bakai-Ata region, Talas r.
4	Klyuchevka	0.061	N/A	Bakai-Ata region, Talas r.
5	Talas	0.150	1955	Manas region, Talas r.
6	Ivanovo-Alekseevka	0.123	1955	Talas region, Talas r.
7	Talasskaya	0.450	1955	Talas region, Talas r.
8	Kyrk-Kazyk	0.746	N/A	Talas region, Talas r.
9	Karakol	0.155	1956	Talas region, Karakol r.
10	Budennovskaya	0.176	1955	Talas region, Uch-Koshoi r.

Table 3-3-5 List of Abolished Small HPPs in Osh Oblast and Batken Oblast

No	Name of plant	Capacity (MW)	Year of startup, design	Location of SHPP, name of water course
1	Dzhusaly	0.090	1953	Alai region
2	Gul'cha	0.240	1959	Alai region, Gulcha r.
3	Pravda	0.277	1953	Alai region
4	Sufi-Kurgan	0.690	1963	Alai region, Gulcha r.
5	Muyan	0.615	1958	Kara-Sui region, Ak-Bura r.
6	Oshskaya-1	2.500	N/A	Kara-Sui region, Ak-Bura r.
7	Oshskaya-4	1.500	N/A	Kara-Sui region, Ak-Bura r.
8	Oshskaya-5	1.500	N/A	N/A
9	Yakolik	0.072	1950	N/A
10	Osh-Mady	0.048	N/A	Kara-Sui region
11	Kichik-Uzgen	0.020	N/A	Kara-Sui region

12	Narimanova	0.294	1940	Kara-Sui region
13	Kirova	0.017	1947	Kara-Sui region
14	Chon-Alai	0.104	1963	Chon-Alai region
15	Molotovabadskaya	0.334	N/A	Kadamzhai region, Isfairam-Sai r.
16	Molotovabadskaya-2	0.400	1955	Kadamzhai region, Isfairam-Sai r.
17	GES Frunzenskaya	0.450	1959	Kadamzhai region, Shahimardan r.
18	Kyzyl-Kiya	0.052	1950	Kadamzhai region
19	Chauvai	0.390	1955	Kadamzhai region
20	Abshir-Sai	0.084	1950	Kadamzhai region, Abshir-Sai r.
21	Kyzyl-Shura	0.019	N/A	Kadamzhai region
22	Yangi-Naukatskaya	0.213	N/A	Naukat region
23	Kirgiz-Ata	0.120	1950	Naukat region
24	Bakir	0.086	1953	Naukat region
25	Naukat	0.072	1940	Naukat region
26	Imeni Fedorova	0.091	1950	Naukat region
27	Chapaeva	0.029	1948	Naukat region
28	Kyzyl-Asker	0.013	1946	Naukat region
29	Kyzyl-Sai	0.012	1946	Naukat region
30	Aravan	0.544	1941	Aravan region, Kyrgyz-Ata r.
31	Sovetskaya	0.760	N/A	Kara-Kuldzha region
32	Kulunda	0.544	N/A	Lyailyakskii region
33	Kyzyl-Tadzhik	0.024	1950	Lyailyakskii region
34	Isfana	0.083	1952	Lyailyakskii region
35	Kara-Suu	0.300	1955	Karasui region
36	Kyzyl-Sengir	0.120	1954	Uzgen region
37	Kurshab	0.079	1941	Uzgen region
38	Ak-Dzhar	0.216	1952	Uzgen region
39	Atamkul	0.220	1951	Uzgen region
40	Uzgen	0.270	1952	Uzgen region
41	Yan-2	0.180	1960	N/A

Table 3-3-6 List of Abolished Small HPPs in Jalal-Abad Oblast

No	Name of plant	Capacity (MW)	Year of startup, design	Location of SHPP, name of water course
1	Muztor	0.736	1959	Toktogul region, Chichkan r.
2	Yangi-Turmysh	0.500	1958	Toktogul region
3	Torkent	0.340	1960	Uch-Terek region, Torkent r.
4	Tortuluk	0.220	1958	Uch-Terek region
5	Orto-Aziya	0.250	1959	Suzak region
6	Voroshilova	0.120	N/A	Suzak region
7	Dzhangi-Dzhol	0.250	1954	Aksyi region
8	Alga	0.200	1956	Aksyi region
9	1 Maya	0.820	1963	Bazar-Korgon region
10	Bazar-Kurgan	0.166	1940	Bazar-Korgon region, Kara-Ungur r.
11	Sakaldinskaya	0.800	N/A	Bazar-Korgon region
12	Maili-Sai	0.244	1953	Bazar-Korgon region, Maili-Suu r.
13	Lenin-Dzhol	0.065	1953	Bazar-Korgon region

14	Chatkal	0.358	N/A	Chatkal region, Chatkal r.
15	Chanach	0.100	1950	Ala-Buka region, Chanach r.
16	Oktyabr'skaya	0.440	1953	Suzak region, Kugart r.
17	Arhangel'skaya	0.600	1957	Suzak region
18	Tabylgaty	0.300	N/A	Toguz-Torouz region
19	Arkit	0.045	N/A	Karavan region, Hodzha-Ata-Sai r.
20	Karavan	0.473	1943	Aksyi region

Figure 3-3-1 shows number of abolished small HPPs summarized in output range.

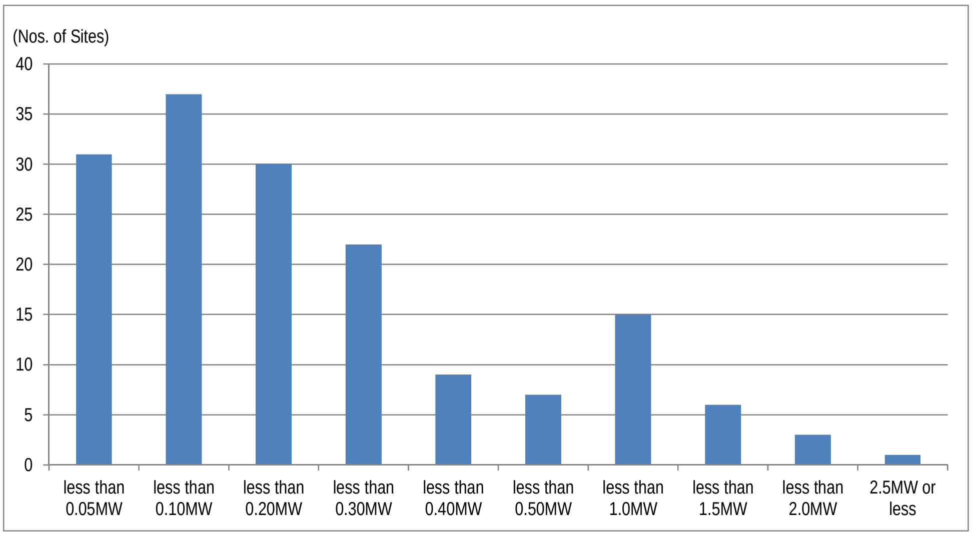


Figure 3-3-1 Number of Abolished Small HPPs Summarized in Output Range

As shown in Figure 3-3-1, output of many small HPPs (120 of 161 plants: 75%) is less than 0.3 MW. Numbers of plants whose output are 1.0 MW or more are 10 plants and Maximum output is 2.5 MW of Oshkaya-1 HPP located in Osh Oblast.

3-3-2 Operational Conditions of Existing Facilities

1. JSC Chakan GES

JSC Chakan GES located near the capital Bishkek has owned and operated nine numbers of small HPPs shown in Table 3-3-7.

Table 3-3-7 List of Small HPPs owned by JSC Chakan GES

No	Name of plant	Capacity (MW)	Commissioning year	Location of SHPP
1	Lebedinovka	7.6	1943	Located on the Western Big Chui Channel
2	Alamedin No.1	2.2	1945	Located on the Western Big Chui Channel
3	Alamedin No.2	2.5	1948	Located on the Western Big Chui Channel
4	Alamedin No.3	2.1	1951	Located on the Western Big Chui Channel
5	Alamedin No.4	2.1	1952	Located on the Western Big Chui Channel
6	Alamedin No.5	6.4	1957	Located on the Western Big Chui Channel
7	Alamedin No.6	6.4	1958	Located on the Western Big Chui Channel

8	Alamedin Midget	0.4	1928	Located on the Western Big Chui Channel
9	Bystrovka	8.7	1954	Located neer the town of Kemin

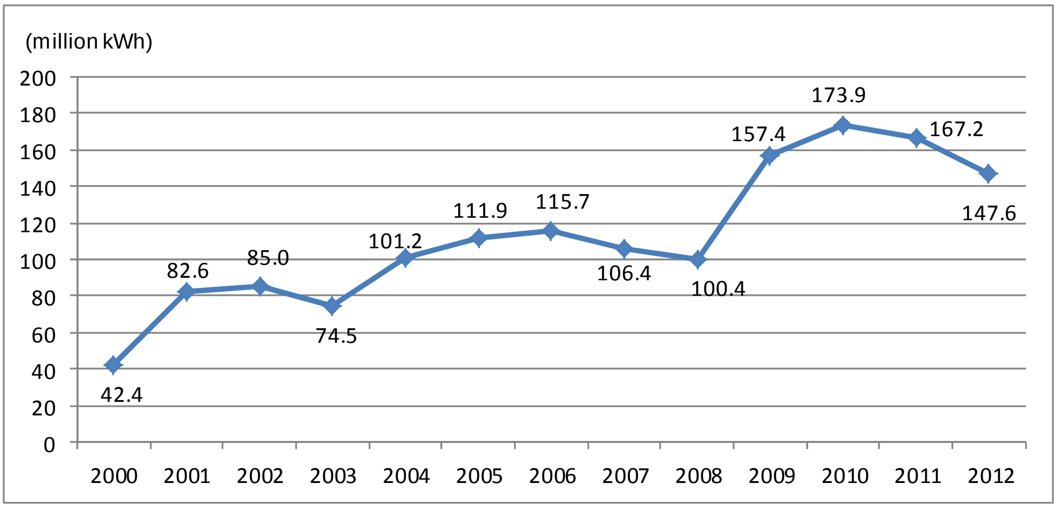
(Source: JSC Chakan GES)

According to the interview with JSC Chakan GES, eight small HPPs except Lebedinovka HPP is operating normally without any troubles with equipment. Lebedinovka HPP has two sets of water turbine generators and both of sets have serious trouble with main shaft. Due to this trouble, Unit No.2 (horizontal Francis type) has not been able to operate for a few years and Unit No.1 (Vertical Francis type) is operating while suppressing its output to 2.9 MW despite its installed capacity of 4.0 MW.

(Source: JSC Chakan GES)

Photo 3-3-1 Generator of Lebedinovka HPP Unit No.2 Stopped by Trouble

Figure 3-3-2 shows the total annual power generation by all HPPs owned by JSC Chakan GES from 2000 to 2012.

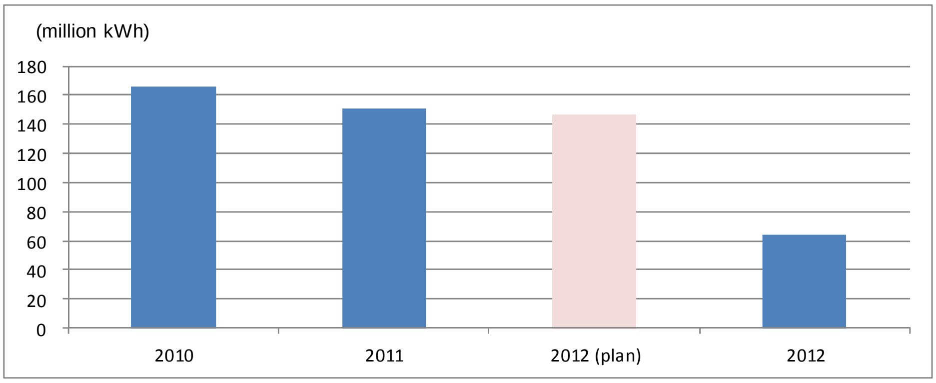


(Source: JSC Chakan GES)

Figure 3-3-2 Annual Power Generation of JSC Chakan GES (from 2000 to 2012)

The amount of annual power generation has been increasing at about 10% per year over 2000 when JSC Chakan GES was separated from Bishkek enterprise of electric networks and became a joint stock company. According to JSC Chakan GES, the main reason for this increase is that the cleaning and inspection of the irrigation channel was downsized significantly. In addition, in 2009 when Bystrovka HPP became part of JSC Chakan GES, the amount of annual power generation was further increasing and recorded the peak value in 2010. The amount in 2011 and 2012 was decreased by the stoppage of Lebedinovka HPP due to the trouble with equipment. The amount in 2012 fell by about 20 mil. kWh compared to that in 2011. The main reason for this fall is decrease of water flow in Chu River.

Figure 3-3-3 shows annual power generation exported to Kazakhstan from2010 to 2012.

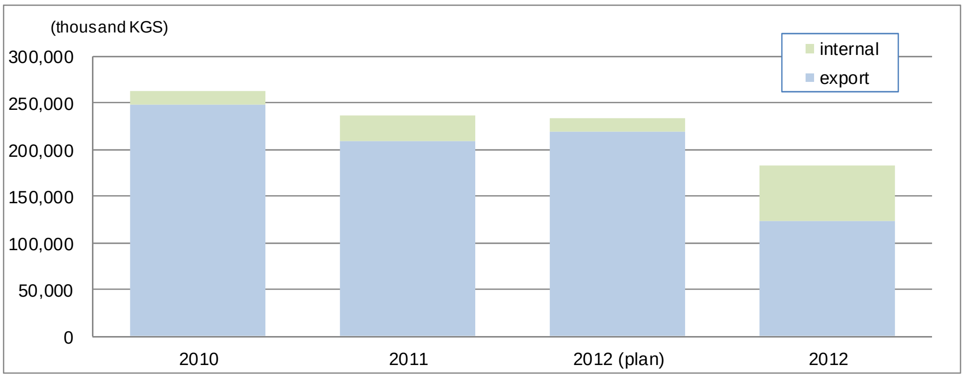


(Source: JSC Chakan GES)

Figure 3-3-3 Annual Export Power Generation of JSC Chakan GES (from 2010 to 2012)

This figure shows that JSC Chakan GES exported the most annual power generation to Kazakhstan in 2010 and 2011. The reason for this is that selling price for export (USD 0.03/kWh) is higher than that for domestic use (e.g. for a distribution company: 0.992 som/kWh). In 2012, JSC Chakan GES also planned to export the almost same amount as past two years. However, the exported amount in 2012 was less than half of the previous year due to the governmental restriction of power export.

Figure 3-3-4 shows annual revenue from electricity sales of Chakan GES from 2010 to 2012.



(Source: JSC Chakan GES)

Figure 3-3-4 Annual Revenue from Electricity Sales of Chakan GES (from 2010 to 2012)

As shown in Figure 3-3-5, Percentage of exports to total annual revenue in 2010 and 2011 is large since most power generation was exported. However, percentage of domestic uses is increasing due to the governmental restriction of exports in2012 and total revenue is decreasing because selling price for domestic use is lower than that for exports.

The total number of employees of JSC Chakan GES is approximately 250 and 150 of the total belong to the engineering sector. The average age of employees is 41 years old. Figure 3-3-5 shows organization structure of JSC Chakan GES engineering sector.

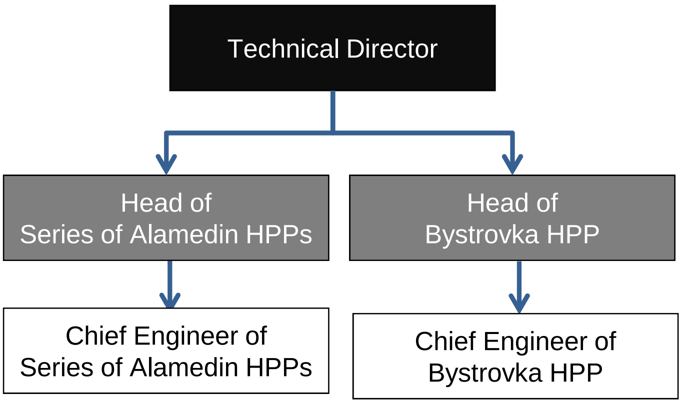


Figure 3-3-5 Organization Structure of JSC Chakan GES Engineering Sector

Under Technical Director, the engineering sector is composed of two departments. One department is in charge of Series of Alamedin HPPs and another department is in charge of Bystrovka HPP. Under each Chief Engineer, there are a number of teams that specialize in operational command, electrical engineering, protective relay, etc. For the purpose of training of technical personnel, JSC Chakan GES is planning to establish a training center in Alamedin Midget power plant and open the center not only to their employees but also to university students. However, JSC Chakan GES cannot allocate the budget for the center and the plan does not materialized at all so far.

JSC Chakan GES has carried out periodical inspection in order to keep the function of power plant equipment on good condition. External inspection including test for protective relay and control system is conducted every year and necessary period for the stoppage of water turbine generator is three or four days. Internal inspection for water turbine, etc. is conducted every four years with local sub-contractors and necessary period for the stoppage of water turbine generator is about forty-five days.

2. ARK, a private small hydropower producer

Then, one of private companies for small hydropower producer, ARK is described. ARK was founded in 2005 by Mr. Sergey who is a First Deputy Managing Director of Directorate, the governmental organization. ARK owns and operates one small HPP, Issyk-Ata that was built by ARK with the loan from the bank of Germany. Now ARK is constructing a small HPP (2MW) in Issyk Kul Oblast and waiting for the delivery of water turbine generator.

Table 3-3-8 shows the main specifications of Issyk-Ata HPP

Table 3-3-8 Main Specifications of Issyk-Ata HPP

Name of HPP	Effective Head	Discharge	Nos. of Units	Output
Issyk-Ata	60m	3.6m3/s	2	1.6 MW (0.8*2)

(Source: ARK)

Photo 3-3-2 Water Turbine Generator of Issyk-Ata HPP

The amount of Annual power generation of Issyk-Ata HPP is about 11.5 mil. kWh and generated power is being directly sold to an industrial company through a distribution company. Selling price to the industrial company is 1.5 som/kWh and the contract period is ten years. ARK pays 0.18 som/kWh to the distribution company as wheeling rate.

ARK has eleven staff and five of them are in charge of Director, Deputy Director, Accountant, Procurement and Financial Specialist respectively as administration staff. As engineering staff, there are seven including an operator of the 24-hour, a maintenance master (in charge of 2.4 km water channel) and two patrols for channel.

3-3-3 Framework for Operational Management of Small Hydropower project

If a small HPP is constructed by Japan's Grand Aid, a candidate who operates and maintains it is shown in Table 3-3-9.

Table 3-3-9 List of Candidates for Small Hydropower producer

	JSC EPP	JSC Chakan GES	KSTC	ARK
Category of Organization	State-owned enterprise	State-owned enterprise	Governmental Organization	Private Company
Number of staff	4,300	250	70	12
Number of HPPs	7	9	0	1
Total Capacity of HPPs	3,030 MW	38.4 MW	0	1.6 MW
Financing Status	Revenue from electricity sales is suppressed due to cheap tariff. Therefore, budget for extensive renovation or new construction cannot be allocated.	Revenue from electricity sales is suppressed due to cheap tariff. Therefore, budget for extensive renovation or new construction cannot be allocated.		By revenue from electricity sales, the construction cost (loans from German Bank) is repaid.
Features	Own, operate and	Own, operate and	A research	Established a few

	maintain HPPs of medium-scale or more.	Maintain small HPPs for a long period.	institution, there is no experience with the operation of HPPs.	years ago, have small experience in operating small HPPs.

JSC EPP is a state-owned enterprise and the largest generation company in Kyrgyzstan. Currently, JSC EPP doesn’t have any small HPPs. However, there is no big difference in the way of operation and maintenance between scales, so it is supposed that there is no technical problems. On the other hand, JSC EPP doesn’t have any HPPs in Chui Oblast where a project is being planned. Therefore, JSC EPP may be forced to manage the organization inefficiently such as in terms of the arrangement of the staff.

JSC Chakan GES has experience in operation and maintenance of small HPPs over the long period and is located in Chui Oblast. Therefore, Chakan GES is the most appropriate organization of the candidates of the above.

KSTC is a governmental organization (under MEI) and there is no problem as the operator of the HPP that is constructed by Japan’s Grant Aid. However, the main task of KSTC is scientific research and KSTC has no experience in operation and maintenance of a small HPP. Therefore, the capacity of KSTC concerning the operation of a small HPP is unknown.

A private company, ARK owns a small HPP, but ARK has less experience in operation and maintenance and its company scale is small. Therefore, it cannot be said to be no problem for the sustainability of its operational management system.

According to the revenue from electricity sales and the cost for operation and maintenance of the project site, the balance concerning the project site must be separated from the entire balance of the organization in order to secure transparency.

3-4 Small Hydropower Development Plan

According to MEI, the government is ready to accept a various kind of small hydropower projects such as bringing projects from the private sector, governmental bidding projects, donors' assistance projects, etc., even if those are not mentioned in the "Small Hydropower Development Plan", for the purpose of early realization of those developments.
Within this context, the "Small Hydropower Development Plan" shown herein is not all of the hydropower candidate sites, but the approaches of MEI for the current and future planning of "Small Hydropower Developments" are shown in the followings.

3-4-1 Current Planning of Small Hydropower Developments

"Small Hydro Development Plan until Year 2012", issued by the 2008 Presidential Decree, is shown in Table 3-4-1 as the latest plan in Kyrgyzstan.
The abovementioned plan consists of 41 candidate sites across the country, inclusive of 28 sites of new development projects, 4 sites of renovation projects for existing plants, and 9 sites of reconstruction projects for abolished small hydropower plants. Details of the respective candidate sites are unknown but only generation capacity thereof are known in the plan as therein shown.

This development plan was investigated proactively by the "Directorate for the Small and Medium scale Power Generation Project". Therefore, if a Japan grant aid project is selected from this plan, its development, operation and maintenance will be most likely done by the Directorate that has poor experience of implementation of hydropower development, operation and maintenance, according to MEI.

3-4-2 Future Planning of Small Hydropower Developments

Based upon the support of EBRD, MEI has completed the small hydropower master plan study in July 2011 in the report of "Strategic Planning for Small and Medium Sized Hydropower Development, EBRD, July 2011". In this master plan, future small hydropower development plan is proposed as shown in Table 3-4-2.
In this master plan study, 20 candidate sites are firstly extracted from 158 candidate sites across the country in views of evaluations of economical efficiencies, river flow discharges and the social environment aspects for the small hydropower development candidates. Finally, promising 4 candidate sites as the highest potential sites are selected for future developments from the abovementioned extracted 20 candidate sites.

The abovementioned 20 candidate sites are chosen by focusing upon 61 rivers across the country having a river flow discharges of 0.5m3/s or more, that include i) 5 candidate sites of new small-sized hydropower (0-10MW), ii) 6 candidate sites of new medium-sized hydropower (10-30MW), iii) 4 candidate sites of reconstruction hydropower upon abolished plants, and iv) 5 candidate sites by using idle head and/or water flow of existing irrigation facilities.
From the viewpoint of economical, social and environmental aspects, the following 4 candidate sites are selected out of the abovementioned 20 candidate sites.

- Sokulukskaya-5 Site (1.5MW)
  New small-scale hydropower development (0-10MW) of less than 10MW
- Oy-Alma Site (7.7MW)
  New medium-scale hydropower development (10-30MW) of less than 30MW
- Orto-Tokoyskaya Site (20MW)
  Development using the idle head and/or water flow of existing irrigation facilities

- Tortgulskaya Site (3MW)
  Development using the idle head and/or water flow of existing irrigation facilities

It is noted in the report that, initially as a pilot project, it was trying to extract one each candidate site for the abovementioned four (4) classifications, i) to iv), but by the terms of the social environment aspects, there are circumstances in which any candidate could not be extracted from "iii) reconstruction plant".

EBRD is continuing to support the creation of draft tender documents for the 4 candidate sites extracted in this master plan study. The consultant of EBRD, i.e., Mercados (Spain) and RusHydro (Russia) has completed the draft tender documents and submitted them to MEI in April 2013 while MEI has a plan to start the bidding procedures in August 2013.
According to MEI, based on the results of this master plan study, an updated small hydropower development plan will be formulated, which is being prepared aiming to MEI’s approval in September 2013.

Table 3-4-1 Current Planning of Small Hydropower Developments (2008 President Decree)

Type of development	Oblast (Region)	Site		Installed capacity (MW)
A) New Small HPPs	Chuiskaya	1	Shamsinskaya	2.4
		2	Alamedinskaya	3.2
		3	Suusamyrskaya	14
		4	Chon-Keminskaya (3 stations x 5 MW each)	15
		5	Karakolskaya	3
	Issyk-Kulskaya	6	Chon-Aksuyskaya	10
		7	Enilchekskaya	2
		8	Ak-Saiskaya	1.2
		9	Ak-Tilecskaya	1.2
		10	Ak-Bulun 1	1.2
		11	Ak-Bulun 2	1.35
		12	Darhan	1.2
		13	Kuiluscaya	1.9
		14	Turasu	0.5
		15	Tamga	2
		16	Chon-Sary-Oi	1.6
		17	Baykchy City Outskirts	22
	Narynskaya	18	Kokomerenskaya (Not "small" HPP)	70
		19	Kochkorskaya	3
		20	Suekskaya	1.6
	Oshskaya	21	Karatashskaya	3
		22	Salamalikskaya	3
		23	Austanskaya	3
	Djalalabadskaya	24	Synynskaya	4.4
		25	Janyjolskaya	3.5
		26	Sarybulakskaya	2
		27	Sandalashskaya	12
	Batkenskaya	28	Austan	3
B) Construction of plants at existing facilities	Kirovskaya	29	Kirovskaya SHPS	23
	Issyk-Kulskaya	30	Orto-Tokoiskaya SHPS	20
	Oshskaya	31	Papanskaya SHPS	20
	Batkenskaya	32	Tortkulskaya SHPS	8
C) Restoration of ruinous or abandoned HPPs	Chuiskaya	33	Sokuluk-1	2
		34	Sokuluk-2	1.2
		35	Karabaltinskaya	1.6
	Issyk-Kulskaya	36	Arasanskaya	1.2
	Narynskaya	37	At-Bashinskaya	40
	Talaskaya	38	Leninopolskaya	1.6
		39	Talaskaya	0.15
		40	Ivano-Alekseevskaya	0.123
		41	Budenovskaya	0.116
TOTAL				311.24

(Source: Small Hydro Development Plan until Year 2012,
As approved by Presidential Decree No. 365 of 14 October 2008.)

Table 3-4-2 Future Planning of Small Hydropower Developments (EBRD, 2011)

Categories	Site	Installed capacity (MW)	Generation Cost (USD/MWh)	Merit Order
A) New small HPPs (<10 MW)	1 Arpatekti-2	4.00	103.99	2
	2 Chon-Keminskaya-1	4.20	117.59	4
	3 Kurkureu	1.30	237.79	5
	4 Lenger	3.00	114.95	3
	5 **Sokulukskaya-5**	1.50	97.83	1
B) New medium HPPs (<30 MW)	6 Ak-Burinskaya-1	5.85	99.69	1
	7 Chatkalskaya	6.15	120.8	3
	8 **Oy-Alma**	7.70	104.85	2
	9 Oytal (Laytala)	4.05	179.08	4
	10 Taldysuyskaya-1	2.78	281.61	5
	11 Taldysuyskaya-2	2.07	295.53	6
C) Restoration of ruinous or abandoned HPPs	12 Aksuyskaya-1	1.98	135.1	2
	13 Aksuyskaya-2	1.73	163.04	3
	14 Arashan	2.15	107.03	1
	15 On-Archa	1.38	187.35	4
D) Construction of plants at existing irrigation facilities	16 Kirovskaya	21.00	104.06	3
	17 Kugartskaya	4.00	96.54	2
	18 **Orto-Tokoyskaya**	20.00	105.21	4
	19 Papanskaya	20.00	109.99	5
	20 **Tortgulskaya**	3.00	80.07	1
TOTAL		117.84	-	-

(Source: KYRGYZ REPUBLIC: STRATEGIC PLANNING FOR SMALL AND MEDIUM SIZED HYDROPOWER DEVELOPMENT, EBRD (Mercados), July 2011)

3-5 Donors' Assistance Activities for Small Hydropower Developments

3-5-1 Support by UNDP

◆ Policy Support：

The Renewable Energy Law was enacted in 2008 for the introduction of the feed-in tariffs. This is what UNDP has achieved by continuing policy support on an ongoing basis. Under the control of the MEI, MEI and UNDP formed a working group with the state-owned power entities for discussing the contractual period and the fixed price of the mechanism of the feed-in tariffs, while UNDP has led to the revision of the law in August 2012.

UNDP has been working in the same working group during the operation of the feed-in tariff system and continuing to study a trial calculation of the deficit between fixed purchasing prices and electricity selling tariffs, which is to be reported to MEI in May 2013.

According to estimates by UNDP in the above-mentioned trial calculations, even if total amount of small hydropower has been developed up to 100MW level, deficit between fixed purchasing prices and electricity selling tariffs will impact on 0.01Som/kWh as electricity tariff surcharges that are only approximately 1% increase from the weighted average tariff 0.879Som/kWh in 2013. From this, UNDP has a plan to propose to MEI that a fixed purchasing price should be more increased and also should extend the contractual period of the feed-in tariffs for promoting further private participation. Further, UNDP will propose to MEI not only new development projects but also rehabilitation projects to be in the frame of the feed-in tariffs.

On the other hand, according to MEI, IFC (International Finance Corporation) would like to join a working group of MEI and UNDP to lead policy support and private participation support of small-scale hydropower developments.

◆ Support on Micro Hydropower：

UNDP-GEF has implemented the project of the grass-roots level of 14,000 since 1992 to date. Of this, power generation projects are 10 projects, and all of those have made off-grid electrification support of less than 100kW. The typical example of the power generation projects thereof can be shown below.

- Project Name : Juniayu Micro Hydropower Project
- Installed Capacity : 12kW
- Beneficial Target : Un-electrified 10 House-Holds
- Operation by : Villagers trained in the project

◆ Support on Small Hydropower：

Small hydropower projects supported by UNDP have been placed in the emphasis on entry of private enterprises. UNDP has been supporting feasibility studies, designs, bidding preparations, etc., for which annual budget USD 0.15mil. is assigned. So far, the following three (3) small hydropower projects have been supported by UNDP.

- Karinsukaya Small Hydropower Project (Chui Oblast, 2.2MW, operating by Kyrgyzstan and France joint enterprise)
- Ibragimov Small Hydropower Project (Bakken Oblast, 700kW, For Coal Mining, planning)
- Wellman Homat Small Hydropower Project (Jalal-Abad Oblast, For Gold Mining, planning by German company)

3-5-2 Support by EBRD

Based upon support of EBRD, "Strategic Planning for Small and Medium Sized Hydropower Development" was carried out for the nationwide small hydro potential survey by the consultant of Mercados (Spain) and RushHydro (Russia), and submitted to MEI in July 2011.

In this study, 20 candidate sites are firstly extracted from 158 candidate sites across the country in

views of evaluations of economical efficiencies, river flow discharges and the social environmental aspects for the small hydropower development candidates. Finally, promising 4 candidate sites as the highest potential sites are selected for future developments from the abovementioned extracted 20 candidate sites.
EBRD is continuing to support the creation of draft tender documents for the abovementioned 4 candidate sites extracted in the study. EBRD has completed the draft tender documents and submitted them to MEI in April 2013 while MEI is aiming to bid proceedings in August 2013.
According to MEI, EBRD is ready to provide financial support to winning bidders for the selected 4 projects, but details are unknown.

3-5-3 Support by Norway

For micro-hydropower (less than 100MW), three (3) pilot projects (20kW to 40kW) have been implemented by Norway. In these pilot projects, villagers were trained for not only technical scheme but also accounting management for the operation and maintenance of the projects. Norway also launched micro-hydropower development mechanism that the projects are funded by a bank and the loan repayment shall be borne by the operators of villagers in rural area. However, since the focus is placed upon construction at low cost by using equipment made in China and Russia, sufficient effects of the projects could not be obtained due to poor quality of the equipment. For more information, the report of “Financial Engineering for Small Hydro Power Project in Kyrgyzstan, Completion Report, in February 2009” is prepared by Norway.
For small and medium-sized hydropower, consultant of Norway (Norconsult AS) has been implementing the pre-feasibility study of Shamsi small hydropower sites in 2012 upon the request of MEI, which is reported in the report of “The Small Hydropower Assessment, Shamsi Hydropower Project-Assessment of Feasibility (October 2012)”. It is added that this potential site is one of “the Small Hydropower Development Plan (2008)” of Presidential Decree No.365.
However, as a result of field research by the study team, the intake flow of the project is set to 8.5m3/s in the report, but the actual river flow discharge of the dry season is observed at 0.6m3/s only by visual estimate. Further, another intake facility for irrigation channel was found between intake and power house of the project.

3-5-4 Private Participation of Green Fund by German Bank

Directorate of Small and Medium Scale Power Generation Development (hereinafter “Directorate”) of the government becomes an intermediary for usage of the green fund of commercial banks in Germany.
As activities so far done by Directorate, Issyk-Ata small hydropower plant was built by the subsidiary company of Directorate upon reconstruction of abolished power plant in 2008. The subsidiary company is under loan repayment to the abovementioned green fund. With the support of German banks, small hydro German experts made guidance for operation and maintenance method to Directorate and the subsidiary company.
Directorate has played the role of attracting investment from other countries for the next development of small hydropower plants in Kyrgyzstan. There is a possibility that the support of the Green Fund and the like from other countries, not limited to Germany, is utilized by Directorate in the future.

3-6 Issues on Small Hydropower Development

1. Need for Definition of Purchase Period in the Feed-in Tariffs

Basic framework of the feed-in tariffs for renewable energy has put into place since 2008. In the mechanism of the feed-in tariffs, rules of the fixed purchase rate (=maximum tariff to consumer x 2.1 times) have been established. However, MEI still has an authority to set purchase period, less than 8 years, based upon evaluation of profitability in each individual project. Though only the price is fixed, there is a possibility that the purchase period is shortened than the period expected by developers, and developer's incentives may not work. MEI is required to clearly define in advance not only a fixed price but also a purchase period for developer's investment decisions with making some profitability.

2. Need for Revision of the Feed-in Tariff Mechanism

Since establishment of mechanism of the feed-in tariffs in the renewable energy law in 2008, a few of small HPPs have been developed to date such as Issyk-Ata small HPP (1.6MW) arranged by Directorate for the Small and Medium Scale Power Generation Projects of the government. It is reality that the feed-in tariffs is not reached at the level that attracts the investment of private enterprises, and therefore enough spread of small hydropower development has not yet been made to date.

Under these circumstances, based on estimates of UNDP, the influence of the tariffs to consumers are small and approximately only 1% increase from the current level even developed 100MW of new small HPPs. For accelerating private participations, the mechanism of the feed-in tariffs should be reviewed and revised taking into consideration of i) fixed price hike, ii) extension of purchase period, and iii) including not only new projects but also rehabilitation projects.

3. Need for Promoting the Government-led Biddings

For the purpose of promoting investments in small HPP developments, MEI needs to open information, such as a small hydropower development plan, to the public who do not have the information of hydropower potentials. Based upon the support of EBRD, i.e., "Strategic Planning for Small and Medium Sized Hydropower Development, EBRD, July 2011", MEI should formulate a new small hydropower development plan soon. According to the development plan, the government-led biddings, i.e., solicited IPPs, should be accelerated for promoting the private participation upon the small HPP developments. The matters mentioned above are currently under proceeding, initiated by MEI.

4. Treatment of Un-transparency of Retained Earnings

Stock dividend rate is different in each case for the power entities. It must be paid to SPF at 70% or more of dividends in some cases even making efforts for profits. It is reality that enough profit as retained earnings is not left for the future overhauling and replacement of equipment, which lead to unsuitable operation and maintenance of the plants. In a grant aid project particularly, it is required to clearly define the money flow in advance for a sustainable operation and maintenance of the project. For achieving the above, it is necessitated i) to wait for the launch of Regulation Center and Settlement Center to ensure transparency of accounting system and/or ii) to establish the separate accounting management system such as the other escrow accounting system only for a small hydropower plant.

5. Adequate Ownership and O&M Organizational Framework of Donors' Project such as JICA's Grant Aid Project

MEI has a policy to carry out a wide variety of small hydropower development types such as i) projects by bringing from the private sector, ii) projects by the government-led tendering to the private, and iii) projects supported by donors such as a JICA's Grant Aid project, and the like. In the abovementioned development types, ownership and O&M organizational framework are still undefined for iii) the projects supported by donors. There are two (2) choices for the ownership from the government-owned organizations, i.e., JSC Chakan GES that has a sufficient operating ability and Directorate that does not have enough operational experience. Those can execute the O&M directory and also work out the O&M to the private sector. An adequate ownership and O&M organizational framework for a JICA's Grant Aid project shall be examined in advance. JSC Chakan GES has experience in O&M management of small HPPs over the long period in Chui Oblast. It is therefore understood that JSC Chakan GES is the suitable entity for the O&M in views of technical and organizational managements.

3-7 Contribution to Policy and Strategic Plan in the Power Sector by Small Hydropower Development

3-7-1 Need for Power Supply Expansion Projects

Power demand and supply plan for the “Base Case: Peak Demand Growth Rate = 2.5%”, described in section 2-7-2, is shown again in Figure 3-7-1. It is understood in the “Base Case” that, although the gap between demand and supply is temporarily mitigated by completion of the 500kV transmission line (Datka-Kemin) in 2015 and some other projects, the worst gap of 500MW is occurred in 2020 just before the completion of Kambarata-1 (1,900 MW) in 2021. It is also concluded that, since the power supply is 250MW below the demand in 2012, “minus value” of RMR of 2012 is observed. In the “Base Case”, this is continued up to the commission of Kambarata-1 (1,900M) which is planned in 2021.

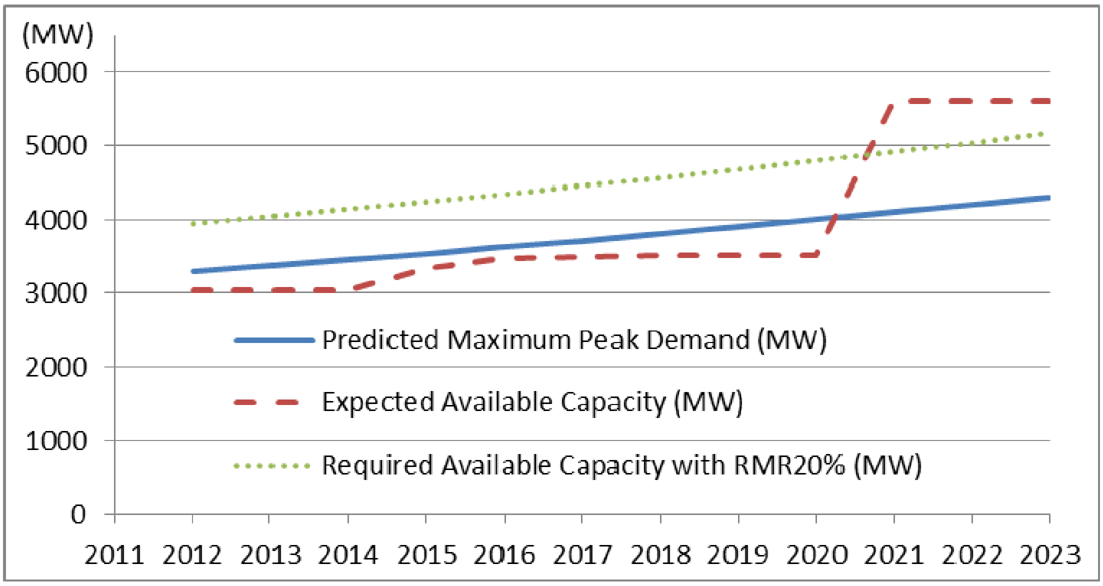


Figure 3-7-1 Power demand and supply plan
(Base Case: Peak Demand Growth Rate = 2.5%)

In general, for a new development of a large-scale HPP, it may take total 8 to 11 years, i.e., 1 year for selection of the candidate site, 1 year for feasibility study, 1 year for tender document preparation and the bidding process, and 5 to 8 years for construction. Namely, if attempting to develop a large-scale HPP immediately from now on, it is difficult to complete it before the commissioning of Kambarata-1 (1,900 MW) in 2021

As a short-term measure in power crisis, simple cycle gas turbines of thermal power plants are commonly installed as an emergency project without distinction of developing countries and developed countries. However, in Kyrgyzstan, there are difficulties in procurement of financial resources for fuel imports as well as the installation of new gas turbines.

From the above, realization of power supply expansion projects is an urgent issue in a short period of time up to commissioning of Kambarata-1 (1,900 MW, 2021).

3-7-2 Short-term Specific Measures against Power Crisis

It is important to realize the short-term specific measures against the current power crisis, for which the "completion fast" and "procurement easy" are required even by a number of small-scale projects to mitigate the power shortage immediately. In view of the short-term specific measures, the power sector of Kyrgyzstan and donors have the following activities.

1. <u>Development of Small Hydropower Plants</u>

On the basis of the Renewable Energy Law enacted in 2008 and revised in 2012, the mechanism of the feed-in tariffs promising expensive purchase is furnished for the hydropower developments with small and medium-sized 30MW or less, aiming to actively enter the private entities, not limited to government entities. Accelerating participations of the private sector using this mechanism can be expected to realize many small HPPs of the "completion fast" and "procurement easy". However, so far, only a few developments such as Issyk-Ata small HPP have been realized and enough development has not been seen.

Under the circumstances mentioned above, MEI is under preparation for revision of the mechanism of the feed-in tariffs with the support of UNDP and also for tendering of four (4) potential sites based on the support of EBRD.

2. <u>Securing and Increasing Power Outputs by Rehabilitation</u>

JSC EPP has plans to increase power output from 175MW to 180MW by the rehabilitation of Uchkurgan HPP and also to increase output from 250MW to 400MW by the renovation of Bishkek central heating PP. These activities are possible to express the effect in the short term.

Currently, ADB is implementing the rehabilitation works on Toktogul HPP and SECO decided to implement the rehabilitation of At-Bashi HPP. These executions have effects not only for increasing power outputs but also for securing power outputs of the existing power plants.

3. <u>Distribution Loss Reduction</u>

High loss level of 20% or more is the norm in distribution losses of Kyrgyzstan in recent years. If reducing 5% distribution losses as assumption, the effect of the same as the increase in output of 40MW can be obtained at the maximum output based on the Buller-Woodrow’s experimental calculation(*). Thus, distribution loss reductions are seen to contribute significantly to the power shortage.

As the recent efforts of the power sector, covering low-pressure lines for commercial loss reduction, replacement of aging transformers for technical loss reduction, and the like are being implemented with the support of KfW and WB.

(*) The abovementioned calculation based upon the formulas of “Annual loses (kWh) = kW Loss × Loss coefficient × 8,760hrs” and the Buller-Woodrow’s experimental formula of “Loss coefficient = 0.3×f+0.7×f2”, where “f” is referred to as “load factor”, and assumed as “0.5”.

4. <u>Energy Saving due to Tariff Hikes</u>

The government is preparing the five-year plan to increase tariffs of twice a year from 2014. This is being prepared with the support of USAID and WB. Though numerical target is not defined, effects of the energy-saving as well as peak load suppression can be expected as the short-term measure against the power shortage.

3-7-3 Fast Project to be expected in the future

Initiatives aimed at short-term measures mentioned above are extremely important in the current Kyrgyzstan. Donors have also been supporting those measures actively.

Under these circumstances, it is highly expected for JICA to urgently support the projects of the "completion fast" and "procurement easy" to mitigate the power crisis before commissioning of

Kambarata-1 (1,900 MW) in 2021.

Lists of fast projects to be expected for an urgent realization, which is not included in the power development plan in section 2-6-1, are summarized in Table 3-7-1. Most of the projects mentioned herein are under examination stage for the respective implementation activities, and therefore most of expected outputs presented in Table 3-7-1 are assumed by the study team.

Table 3-7-1 Additional Power Outputs to be expected in the Future (the study team assumed.)

Expected Project for increasing Power Outputs	Additional Power Outputs (Assumptions)	Assumptions By the study team	Support of Donors	Progress
1) Rehabilitation of At-Bashi HPP	4 MW	10% of installed capacity of 40 MW	SECO	Under Implementation
2) Distribution loss reduction at 5%	40 MW	As described in section 3-7-2 (*)	KfW and WB	Under Implementation
3) Energy saving due to tariff hikes	50 MW	Assumption	USAID and WB	Under Implementation
4) Development of small HPP	50 MW	Upon the ongoing feed-in tariffs, 1% influence to tariffs for 100MW small HPP development. Assumed half of the above.	UNDP and EBRD	Under Implementation
5) Rehabilitation of Toktogul HPP	100 MW	10% of installed capacity of 1,200 MW	ADB	Under studying
6) Rehabilitation of Uchkurgan HPP	18 MW	10% of installed capacity of 180 MW	JSC EPP will be requesting to JICA	Under arrangement of funds
7) Rehabilitation of Lebedinovka small HPP	3 MW	Differential between existing and plan as described in section 6	JSC Chakan GES will be requesting to JICA	Under arrangement of funds

（Total expected additional power outputs ＝265MW）

In case of the power demand and supply plan of “Base Case: Peak Demand Growth Rate = 2.5%” described in section 2-7-2, the gap between maximum power output and peak demand is calculated to be 500MW shortage in 2020 just before the completion of Kambarata-1 (1,900MW, 2021). Assuming that all of the abovementioned projects shown in Table 3-7-1 are completed before 2021, total expected additional power outputs, i.e., 265 MW, can be effective against the 500MW shortage. Thus, the lack of capacity "235 MW" (= 500 MW-265 MW) is estimated and it is observed that demand still exceeds supply in 2020. This power shortage of "235 MW" in 2020 is almost same as the current shortage "250 MW" in winter 2012. Therefore, MEI will have to actively promote the fast projects more such as "small hydropower development project", etc.

3-7-4 Projects that are Expected for Support of JICA

According to Table 3-7-1, projects expected by MEI with the urgent support of JICA are described below.

- As JICA’s Grant Aid Project;
  - "4) Development of a new small HPP (USD 10-20mil.)"
  - "7) Rehabilitation of Lebedinovka small HPP (USD 10-25mil.)"
- As JICA’s Loan Assistance;

- "6) Rehabilitation of Uchkurgan HPP (approximately USD 50mil.)

For these, sufficient investigation has not yet been performed. It should be therefore noted that the following investigation items should be particularly included in the basic design at the next stage.

- For a new development of small HPPs as shown in item 4 of Table 3-7-1
  - Review of the project layout based on topographic survey
  - Review of river flow discharge based on actual measurement
  - Review of maximum intake water and design layout based on the optimum generation plan
- For a rehabilitation of small HPPs as shown in item 6 of Table 3-7-1
  - Understanding details of current situation of the existing power plants by a facility inspection
  - Review of the design layout by drawings and/or site surveys, if necessary, of existing facilities
  - Study of the optimal intake flow based on the previous operation and/or water flow data

It can be considered that the immediate performance of sufficient investigation and the accelerations of the short-term project based upon JICA's assistance are highly expected in the power sector of Kyrgyzstan.

Chapter 4 Environmental and Social Consideration

4-1 Outline

The information and data on environmental and social consideration was investigated and summarized for the development of a small hydropower plant in Chui Oblast by visiting the relevant governmental organizations and by collecting the information on the Internet.

4-2 Regulations relevant to Environmental and Social Consideration on Small Hydropower Plant Projects

4-2-1 Laws and Regulations on Environment

Kyrgyz Republic has taken important steps to reform environmental policies, legislation and institutions over the past 10 years.
The overview of the environmental laws and regulations are detailed on the website of State Agency on Environment Protection and Forestry (hereinafter, SAEPF). Also the environmental laws are available by accessing the database constructed in the conduct of UNDP project. Tabulated below are the list of the laws and regulations considered relevant to small hydropower plant projects.

Table 4-2-1 Environmental Laws and Regulations Relevant to Small Hydropower Plant Projects

Category	Laws and Regulations
Water	- Water Code of the Kyrgyz Republic (January 12, 2005 № 8) - Law "On Water" (January 14, 1994 № 1422-12) - Law "On ratification of the Agreement between the Government of the Kyrgyz Republic and the Republic of Kazakhstan on the Use of Water Management Facilities of Intergovernmental Status on the Rivers Chu and Talas" from 12.06.2001g. № 47 - Law of the Kyrgyz Republic "On the interstate use of water bodies, water resources and water facilities of the Kyrgyz Republic" of 23.07.2001g. № 76.
Forestry	- Forest Code of the Kyrgyz Republic (July 8, 1999, № 66) (amended in 2003, 2005.) - Law "On prohibition of logging, transportation, purchasing and sales, procurement and use, export and import of high value (walnut and juniper) tree species (February 12, 2007, № 15, 30 June 2011, № 340). - Law "On Amendments and Additions to the Decree of the President of the Kyrgyz Republic" On the introduction of a moratorium on the harvesting, processing and marketing of high-value tree species growing on the forest lands of the Kyrgyz Republic " (April 11, 2011 № 149)
Land	- Land Code of the Kyrgyz Republic (June 2, 1999 № 45) - Law "On Subsoil (July 2, 1997, № 42)
Environmental Protection	- Law "On Environmental Protection" (June 16, 1999, № 53) (last amended on April 27, 2009 N 131)
EIA	- Law "On Environmental Impact Assessment" (June 16, 1999, № 54) (last amended on February 26, 2007 № 21)
Ecology	- Law "On Wildlife" (June 17, 1999, № 59) - Law "On Biosphere Territories in the Kyrgyz Republic" (June 9, 1999, № 48) - Law "On Protection and Use of Flora" (June 20, 2001, № 53)
Environmental Safety	- Law "general technical regulation on environmental safety in the Kyrgyz Republic" (May 8, 2009 № 151)
Natural Protected Area	- Law "On Specially Protected Areas", dated May 28, 1994. № 156-12 - Law "On Specially Protected Natural Areas (May 3, 2011 № 18)
Energy	- Law "On Energy"

	- Law "On renewable energy sources" (December 31, 2008 № 283)
Climate Change	- Law "On state regulation and policies on emissions and removals of greenhouse gases," (May 25, 2007, № 71) - Law on "Environmental Security Concept of the Kyrgyz Republic," (2007)
Waste	- Law "Global Technical Regulations" On the safe use and disposal of machinery and equipment "(December 29, 2008 № 280). - Law "On Production and Consumption of Waste" (November 13, 2001, № 89) - On the tailings and waste dumps (2001)
Chemicals	- Law "On ratification of the Stockholm Convention on Persistent Organic Pollutants", 2006.
Others	- The Law "On the mountain areas of the Kyrgyz Republic" (November 1, 2002 № 151)

Law "On Environmental Protection" establishes a legal framework to protect the environment and to ensure the actual use of natural resources, and is the comprehensive head legislation of direct acts. In addition, this law regulates the relationship between public associations and various structures of the state, their rights and responsibilities. The provisions of this Act secure the right of every citizen or organization to have access to environmental information available at public authorities. The general line of the law is to provide science-based combination of environmental and economic interests with the priority of protecting human health and the natural rights of people to a healthy, clean environment in the Kyrgyz Republic.

Law "On Environmental Impact Assessment", regulates the legal relations in the field of environmental impact assessment, aiming at the realization of the constitutional right of citizens to a healthy environment through preventing negative environmental consequences caused by the implementation of economic and other activities. One of the main features of the participation of citizens and their associations in the decision making process in the field of environmental protection and natural resource management is a public environmental review. The Kyrgyz Republic has made two types of environmental expertise: state environmental review and public environmental review.

Law "On Water" addresses relations in the sphere of use and protection of water resources (water treatment), the prevention of environmentally harmful effects of economic and other activities on water bodies and water facilities and the improvement of their condition, to strengthen the rule of law in the field of water relations. In addition, this law regulates the quantity and quality of water discharged into the environment and prohibits discharge of industrial, domestic and other waste and garbage in water bodies as a whole.

The purpose of the law "On the Mountain Areas" is to create a socio-economic and legal framework for the sustainable development of mountain areas, the conservation and sustainable use of natural resources, historical, cultural and architectural heritage. According to this Law, the population of mountain areas has priority. The public along with governmental agencies can carry out research and other work at the expense of the state budget, as well as public and other funds, to track the ecological state of mountain areas.

Law "On Specially Protected Natural Territories" addresses relations in the field of security and management of protected areas for the conservation of standard and unique natural heritage, remarkable natural formations, the gene pool of flora and fauna, the study of natural processes in the biosphere, and monitoring of changes in its condition.

Forest Code of the Kyrgyz Republic establishes the legal basis for the rational use, conservation, protection and reproduction of forests, to increase their environmental and resource potential. It contains rules under which organizations and individuals whose activities affect the condition and reproduction of forests, must keep the public authorities of forest management on the state of conservation and protection of forest plantations, as well as carry out the measures agreed with the local authorities and local administrations, the state controls of forestry and environmental protection technology, including sanitary and other measures aiming at the conservation and protection of forests.

Law "On the International Use of Water Bodies, Water Resources and Water Facilities of the Kyrgyz Republic" defines the principles and main directions of the state policy for international use of water bodies, water resources and water facilities of the Kyrgyz Republic, and is not a directly applicable law. To date the government has not developed mechanisms for the implementation of this law

Law "On Production and Consumption Waste" defines the state policy in the field of production and consumption waste, and is designed to facilitate the prevention of the negative effects of waste production and consumption on the environment and human health while handling them, as well as to maximize the reuse and recycle in the economy as an additional material source.

One of the basic principles of the state policy in the field of waste management are bound by a state environmental review when making decisions on waste management, disclosure, in accordance with the laws, of the information on the waste management, making decisions that affect population interests, taking into account the protection of national interests.

Land Code of the Kyrgyz Republic stipulates the legal basis for the rational use of land resources and regulates relations in the use and protection of land.

Law "On Wildlife" regulates relations in the sphere of protection and reproduction of wildlife and aims at the rational use of wildlife.

Law “On Protection and Use of Flora” regulates relations in the sphere of protection and reproduction of plants, and aims at the rational use of flora.

4-2-2 Laws and Regulations on Social Consideration

Law on Employment Condition

- Labor Code (October 4, 1997 No.70)
- Law On State Guarantees of Equal Rights and equal opportunities for men and women (As amended by the Law of July 14, 2011 N 97)

In constructing or operating a small hydropower plant, the employer shall prepare good working environment and comply with the working conditions stipulated in the law. These articles below are stipulated in the Labor Code.

- Article 281. Ensuring of healthy and safe working conditions
- Article 302. The works where the women's labor is prohibited
- Article 317. The age that labor contracts can be made

It should be noted that labor of persons under 18 years is basically prohibited for hard works, harmful or dangerous works.

Law on Land

Law on Land is explained in 4-5-1.

4-3 Environmental and Social Impact Assessment

4-3-1 Organization on Environmental and Social Impact Assessment

There are two main organizations related to environmental and social impact assessment (hereinafter, EIA) in Kyrgyz Republic. These are:

- SAEPF
- State Inspectorate for Environment and Technical Safety (hereinafter, SIETS)

SAEPF manages and reviews the laws and regulations as well as the institution and also reviews and judges EIA reports.
On the other hand, SIETS is the organization to conduct practical investigations and analyses including EIA.
SIETS was established by merging nine (9) former regulatory agencies under the government into one in order to facilitate the audits over the several regulatory bodies at one-stop. Then a part of the function of SAEPF was transferred to SIETS.
SIETS is the organization whose functions are the supervision and the control for the issues on environmental and technical safety. In more detail, the main tasks are to supervise over (1) the compliance of laws, regulations, and international agreements on environmental and technical safety, and (2) the protection of labor rights, and (3) the protection of the state and public interests, etc. Therefore, SIETS oversees not only the construction of small hydropower plant but also its operation. The outlines of each organization are shown in Figure 4-3-1 and Figure 4-3-2.

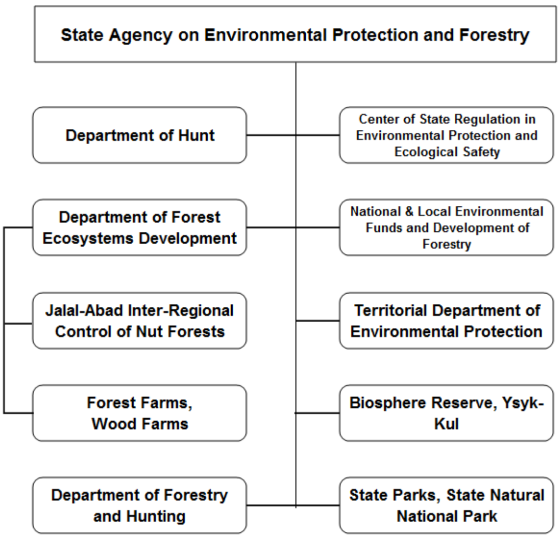


Figure 4-3-1 Organizational Chart of SAEPF

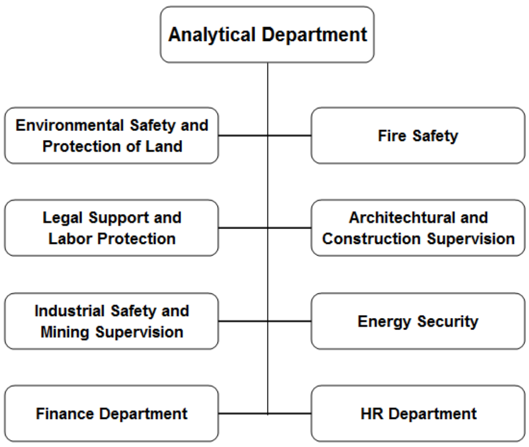


Figure 4-3-2 Organizational Chart of SIETS

4-3-2 Laws and Regulations on EIA

EIA is conducted in accordance with the Law on Environmental Impact Assessment (June, 1999, № 54). This law requires a proponent to conduct two types of environmental assessment, which are state environmental assessment and public environmental review. There are two supplemental guidelines describing the procedures which were developed in 1997 in accordance with the Law "On Environmental Protection" enacted in 1991, but they are no longer effective at present.

- Guidelines for the state environmental review of pre-project/project and other materials and documents in the Kyrgyz Republic

- Instructions on how to assess the impact of a proposed activity on the environment (EIA) in the Kyrgyz Republic

The Kyrgyz Government commenced calling for the comments or the suggestions for the revised new draft guidelines since January, 2013. According to SAEPF, these will be enacted around November 2013.
Kyrgyz Law on EIA is conformed to that of UNECE, because Kyrgyz Republic is a member country of UNECE (United Nations Economic Commission for Europe).
No rules on resettlement and compensation are stipulated in Kyrgyz EIA. The staff from State Registration Service (SRS) or SIETS implements these tasks in accordance with Land Code.

"Instructions on how to assess the impact of a proposed activity on the environment (EIA) in the Kyrgyz Republic" defines the objectives, principles, organization and evaluation of the EIA, and sets the requirements for the framework, content, documentation of the EIA.

"Guidelines for the state environmental review of pre-project/project and other materials and documents in the Kyrgyz Republic" defines the objectives, principles, organization and state environmental expertise, and establishes requirements for the composition, content, materials, and procedure for submission to the state ecological expertise.

Instructions are intended for the experts of the authorized state body in the field of environmental protection, project proponents, experts on EIA, representatives of state bodies and local governments involved in the decision-making process on proposed activities, and the public. Energy facilities including hydroelectric power and high-voltage transmission lines are listed as the designated activities subject to EIA. On the other hand, the instructions also cover the criteria on the requirement of EIA. For example, whether a project area is part of protected area or will become so in the future is one of such criteria.

These guidelines and instructions, however, don't include the items relevant to resettlement and compensation. In addition, these guidelines require to use the best available technology. Except for these points, these documents are almost equivalent to JICA Guidelines for Environmental and Social Consideration.

Although the duration of the state environmental review depends on the complexity of the project, it is usually within three months. A proponent has to pay the fee for state ecological expertise that is the evaluation and judgment by state experts.

4-3-3 EIA for Small hydropower Projects

As for small hydropower projects, the specialist at SAEPF stated a proponent will be probably required to conduct an IEE (Initial Environmental Examination) that is a simplified EIA.
The Study Team asked SAEPF about some concrete items. In the conduct of the Kyrgyz EIA, only hazardous waste shall be evaluated, and general and construction waste are not included, SAEPF explained. The function of water quality monitoring and the facility of test laboratory were transferred from SAEPF to SIETS. Thus, a proponent may ask SIETS for their support, if necessary. A proponent shall secure the licenses on environment in developing a project from Water Resources Agency (under the Ministry of Agriculture) and Development Agency of Forestry (under the SAEPF).
A project development in the protected area is prohibited under the certain condition. (See 4.4.1)

4-4 Protection of Natural Environment

4-4-1 Natural Protected Area and Protection of Forestry

There are two (2) National Parks named Chon-Kemin and Ala-Archa in Chui Oblast, the targeted area of this Study. These two Parks are sorted into Category II of IUCN categorization. According to Kyrgyz Law, a project development is prohibited in these protected areas in principle. However, even in such area, if a given project is highly beneficial to Kyrgyz Republic and if the Kyrgyz government approves the project, it can be implemented. It should be noted the area from the middle to down-gradient watershed of Chon-Kemin River is out of the area of National Park.

Alamedin and Sosnovka are designated as botanical protection area. With regard to the botanical protection area, the expert at SAEPF stated that the area is widely distributed and that the development of small hydropower plant will be probably approved because of the small scale of the project development area. The long River, Aku-Suu, is designated as a multiple protection area in terms of wildlife, vegetation, and aesthetic view. It is likely that there lives rare and/or endangered species. In case of the development within the area mentioned above, once the location to be developed is decided, the vegetation investigation must be conducted. A proponent may ask the Kyrgyz experts to conduct the survey. There is a flower expert in Biology and Soil Institute of National Academy and a plant expert in Institute of Forest.

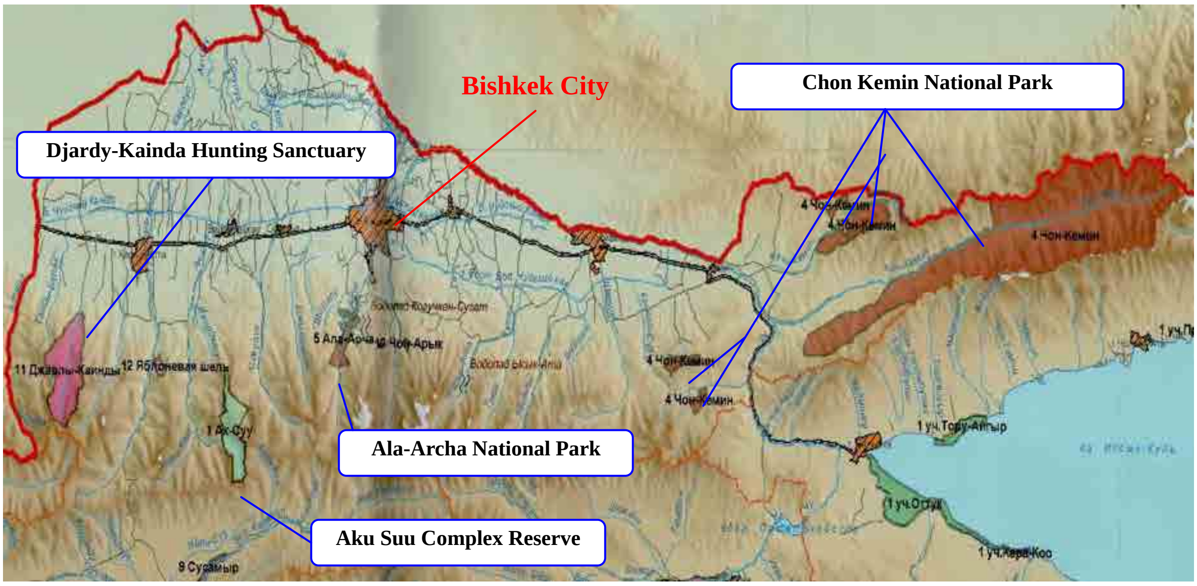


Figure 4-4-1 Map showing Natural Protection Area (Chui Oblast)

By the way, before cutting trees, a proponent has to make the inventory of trees to be cut and pay the fee to an appropriate authority, although this cost is not expensive. The taller a tree is, the more the fee must be paid for cutting the tree. SAEPF oversees the inventory survey in the forest area, while SIETS (State Inspectorate for Environmental and Technical Safety) does in the other area. There is a designated forest area in Kegeti.

Djardy-Kainda is not related to any requirements for development in terms of the protection of ecology, SAEPF explained. However, according to the map showing natural protection area, Djardy-Kainda is named as zoological (hunting) sanctuary. Therefore, how JICA will address this issue should be confirmed. By the way, the impact of the redevelopment is assumed to be limited, because Djardy-Kainda was the site where a small hydropower facility was operated.

4-4-2 Situation of Ecological System

Kyrgyz republic is known as a country with rich biodiversity. However, the ecological system in Chui Oblast is not so diversified.

4-5 Laws and Systems on Land Management

4-5-1 Laws and Regulations

The Constitution of the Kyrgyz Republic recognizes private property rights and protects rights to private property. The principal law regulating land ownership is the Land Code (1999), which was amended most recently in 2009. The small modification of this Law is scheduled in summer, 2013. The Study Team interviewed with the deputy director of Department of Cadastre and Registration of Rights to Immovable Property about this code and the land cadastre. Additionally, the Study Team reviewed the USAID report[1] on Property Rights and Resource Governance summarized in 2011. This report addresses the related laws, land registration, practical situation, and institutional framework. The key points relative to land expropriation and resettlement recognized by the document review and the interview are described in the next section.

4-5-2 System

In 1999 the Kyrgyz government created a single land-administration agency, GosRegister, which integrated the various relative functions. GosRegister started the operation of Kyrgyz registration system of immovable property in 2001 to 2002. In 2009, GosRegister became part of a consolidated State Registration Service (SRS). SRS is the hub for land-administration services, including cadastral surveying and mapping and land registration.
In the interview of this Study, the deputy director answered that SRS will provide the information on the cadastre system to a proponent for free when the location of the project is given to SRS. On the other hand, the information on the ownership of land is available on the system at 2,000COM per month. Approximate 90 to 93 % of land in the rural area is registered in the land cadastre database.

Data Included in Land Cadastre Documentation are as follows:

1) Name of an owner or user of the land plot;
2) Square of the land plot;
3) Type of ownership or use to the land plot;
4) Ttargeted purpose of the land plot;
5) Easements of the land plot:
6) Divisibility or indivisibility of the land plot;
7) Code and number of the land plot;
8) Composition of lands;
9) Qualitative characteristics of lands; and,
10) Other data.

The deputy director stated that the authority of land evaluation falls into the Ministry of Geology and Mineral Resources and that the land cadastre division doesn’t know the procedure. (According to SIETS, it has the function on land evaluation and acquisition. Therefore this function appears to be transferred to SIETS.)

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[1] USAID Country Profile Property Rights and Resource Governance, Kyrgyzstan (2011)

Land Code states that the project exploration works for state and public needs can be the reason for the land redemption. Withdrawal (redemption) of the land plot for state and public needs may be based on the agreement between the authorized agency and a land plot owner/user. In the event of disagreement of the land owner/user with withdrawal (redemption) or its conditions the authorized agency shall have the right to petition to the court within two months following the day of denial regarding compensable withdrawal (redemption) of the land plot. On the other hand, a local authority has the right for public land, the deputy director explained.

The price of the redemption of the land plot is calculated based on the market value of the right to land and the buildings and structures located on the land.
Another land plot with same value may be allocated to a land owner with his consent, which is decided by regional or state government.

A proponent shall obtain the permission to carry out project exploration works. On the process flow of approval of the permission, regional administration creates the draft and then land cadastre division reviews and adds the documents. After that, the document is submitted to the Kyrgyz Government.

In case that a given lot is forest or pasture land, a proponent shall apply for the request of change of land use to the regional office of land cadastre division. Land Code stipulates that State government owns all the pasturelands, but local administrations manage the pastureland. Thus for pastureland, a local administration shall make the decision for the request.

All the processes of project exploration within natural parks shall be approved by the Government of the Kyrgyz Republic. A project proponent shall pay compensation to the Ministry of Geology and Mineral Resources in case of damaging land and to SAEPF in case of damaging environment.

The Study Team asked about the rights of illegal settlers in resettlement, but no clear response was obtained. However, Land Code states that no compensation for land expropriation is paid without the payment of land tax or social tax.

4-6 Water Use

4-6-1 Water Resource and the Usage

According to SAEPF website, a significant part of abstracted fresh water resources in the country (94-96%) is used for irrigation and agricultural water use, which is 4100-4550 million cubic meters per year. The predominant part (80-85%) is used in the growing season. According to the Ministry of Agriculture and Land Reclamation, when a conflict about water use occurs between agricultural use and use for a small hydropower plant, the former always has a priority.

The catchment area of Chui River basin located in Kyrgyz Republic is 15,901 km^2. The runoff of this basin generated in Kyrgyz Republic is 5.0 km^3, 3.85km^3 (77%) of which can be used in Kyrgyz Republic under the international agreement. The range of the actual annual intake of fresh water in Chui Oblast and in Bishkek was 2.85-3.55 km^3 for 2006 to 2010[2].

4-6-2 Irrigation Canal

Ministry of Agriculture and Land Reclamation has been making a map showing irrigation canal in the study of irrigation with the support of GIZ (German Society for International Cooperation). Below is the map showing irrigation canal in Chui Oblast. However, there is no information on small ditch flowing near the mountain area.

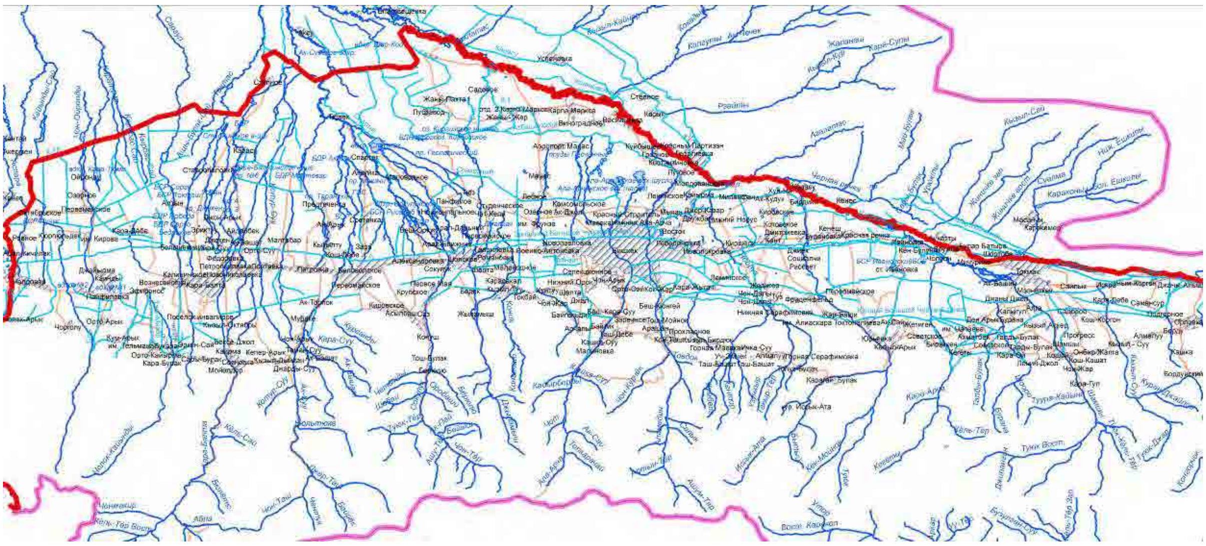


Figure 4-6-1 Location of Irrigation Canals in Chui Oblast
(Source: Ministry of Agriculture and Land Reclamation/GIZ Project)

Note: The location of canals is shown in sky blue.

4-6-3 Climate Change

The annual average precipitation increases slightly from 439.1mm/year (1961-1990) to 471.2mm/year (1991-2010) in Bishkek. Over the past 30 years, the river flow has increased by 6.3%, and the runoff is projected to increase by 10% in the next 20 years[2].

[2] National Report- State of the Environment, Kyrgyz Republic For The Years 2006-2011 (2012, Russian)

Studies carried out in preparation of the Second National Communication on Climate Change[3] noted the influence of climate change to reduce runoff of small rivers flowing from glaciers, due to their reduction. Also seasonal distribution of runoff was predicted to change. Before the 2020-2025 period, the total annual runoff of Kyrgyz Republic is expected to increase from 47-50km^3 to 55.5km^3 and then decrease about 42-20km^3 in 2100, which is 44 to 88% in runoff in 2000. For example, in the scenario that temperature will increase by 1.5℃ and precipitation will decrease by 0.9mm, the decrease of runoff is predicted to 21% in 2050 and 42% in 2100. The consequences might lead to lack of water resources and reduce energy potential and productivity of land.
By the way, such prediction has been calculated by using data with certain uncertainties under a certain scenario. Therefore, it should be noted the calculated result has much more uncertainty.

4-7 Social Consideration on a Small Hydropower Plant Project

4-7-1 Poverty

Table 4-7-1 summarizes main poverty indicators in Kyrgyz Republic[4]. Kyrgyz Republic is known as one of the poorest countries.

Table 4-7-1 Main Poverty Indicator

Indicator	2008	2009	2010
Ginni coefficient (by consumption)	0.252	0.245	0.251
General poverty line, soms per year	18,323	19,417	20,937
Extreme poverty line (by consumption), soms per year	11,710	11,839	12,608
Total poverty level, as a % to total population	31.7	31.7	33.7
Extreme poverty level, as a % to total population	6.1	3.1	5.3

(Source: Kyrgyzstan BRIEF STATISTICAL HANDBOOK 2008-2011, NSC (2012))

IMF prepared Medium-Term Development Program- Poverty Reduction Strategy Paper[5]. This report listed priority action items. A part of energy policies are the following:

1. Required level of energy flow control and relevant payments is not achieved yet, because corruption factors exist. Activity of the Department on regulation of fuel and energy complex (the Regulator) highly depends on non-economic factors.
2. Formation of the mid-term tariff policy for electric and heating power will be an important component increasing sustainability of operation of the energy enterprises. In future, tariffs will be balanced with allowance for all social development factors, including access to these services for the poor.
3. Reforms in the tariff policy will be possible only after improvement of schemes of social protection of the domestic consumers. Targeting program of social protection will be developed for this purpose. At the same time, financing of expenditures for social welfare in the energy sector will be envisaged in the republican budget.
4. Development of the small and medium energy will be encouraged through approval of the legislative measures aimed towards increasing of economic attractiveness of the small hydropower development.

[3] Strategy of the Kyrgyz Republic on Climate Change Adaptation To 2020 (2013)
[4] Kyrgyzstan BRIEF STATISTICAL HANDBOOK 2008-2011, National Statistical Committee of the Kyrgyz Republic (2012)
[5] Kyrgyz Republic: Medium-Term Development Program- Poverty Reduction Strategy Paper, IMF (2012)

4-7-2 Gender

In general, a small hydropower project appears to be gender free. The ADB's environmental assessment report[6] on the grid improvement project also says the project is gender neutral as well as adverse social impact is not anticipated. On the other hand, UNDP/GEF found socio-economic problems likely to have different impacts on women and children in the research on potential social and gender impacts of small and micro HPP on local communities of the Kyrgyz Republic[7]. The report says some problem come from the low access and quality of power supply and from limited access of rural people, especially women to economic resources due to low quality of electricity. They use solid fuel because of the lack of electricity, which likely affects women and children's health as they spend more time at home and inhale gases. Several other findings can be seen in the report.
By the way the Study Team confirmed that all of the villages in Chui Oblast are electrified over this survey. Therefore, these concerns about weak people are recognized to be alleviated in Chui Oblast.

4-8 Supposed Environmental and Social Impacts at Proposed Project Sites

4-8-1 Review Results of the Existing Environmental and Social Impact Assessment Reports

The Study Team reviewed the existing environmental impact assessment reports (EIS) and interviewed with the concerned entities. Although there is the Kyrgyz EIA system as mentioned above, each donor or entity conducted EIA in accordance with the respective guidelines which are considered to cover the requirements of the Kyrgyz EIA.

a) UNDP/GEF Related Projects
According to UNDP personnel, the implementation of EIA is obligatory in Kyrgyz Republic. So, when visiting Issyk-Ata hydropower plant, the Study Team asked the vice president of the plant company about the EIA. However, he just explained that they were required to secure so many permissions from different governmental organizations. He also stated that they have not received any complaints before and during the construction and during the operation so far. He further mentioned, thanks to the electricity generated from this plant, there is no blackout in the vicinity of this plant even when blackout occurs in the surrounding area.
UNDP/GEF has concerns about climate change. That is why it has made efforts to increase electricity generation by small hydropower plants as renewable energy. The responsible person at UNDP energy project mentioned that he expects JICA will construct a small hydropower plant using Japanese excellent technologies and the construction will help the lives of Kyrgyz people.

b) ADB
ADB carried out IEE[8] (Initial Environmental Examination) for the power sector rehabilitation project in accordance with the relevant ADB guidelines:

- Operations Manual Bank Policies (BP): Environmental Considerations in ADB Operations, 2006;
- Safeguard Policy Statement, June 2009, effective since January 2010

Since this rehabilitation project was planned to be implemented only inside of the owned properties, the impacts were considered limited within the properties. Thus, only IEE was conducted in

[6] KGZ: POWER SECTOR IMPROVEMENT PROJECT, INITIAL ENVIRONMENTAL EXAMINATION(IEE), National Electric Grid of Kyrgyzstan & ADB (August 2010)
[7] Study of potential social and gender impacts of small and micro HPP on local communities of the Kyrgyz Republic, UNDP/GEF (2011)
[8] ADB - TA-7704 (KGZ) Power Sector Rehabilitation Project, Initial Environmental Examination (IEE) Rehabilitation of Toktogul HPP (May 2012)

accordance with the above ADB guidelines. However, the contents covered most of the items of the EIA and included the actual measurements of chemical substances that may have an affect on environment.

c) World Bank

World Bank (WB) issued the environmental management plan for energy emergency assistance project at the combined heat power plants (CHPs) in 2008[9]. WB determined the project's environmental category to be "B" which requires limited assessment, because any impacts on the environment were foreseen to be limited, localized and temporary. In this project, the key environmental issues were those related to construction waste management.

d) EBRD

Mercados, a Madrid based consulting company, conducted feasibility studies[10] on the projects of four pilot small hydropower plants under the contract with European Bank. This report specifies the action items to be needed for a tender for the construction of SHPP:

- The entity should receive from the local administration the certificate of allotment for hydropower plant and hydraulic engineering constructions (term:49 or 99 years)
- The entity should apply to the Kyrgyz Ministry of Energy for issuance of the following three licenses:
    1. On power station building
    2. On manufacture; and
    3. On electricity sale

All the issues related to the use of water, as well as interaction with the Kyrgyz State Committee on Water Resources and Land Improvement, must be solved by the owner of the power plant on the contractual basis, with the assistance of the Kyrgyz Ministry of Energy.

The environmental study was conducted in accordance with the EBRD Environmental and Social Policy (ESP), 2008. As for environmental and social consideration, this report addresses the contents shown in Table 4-8-1. As a result of this study, these pilot projects were all determined to be Category C which means to entail almost no adverse environmental and social impacts. Thus, the report concludes no further evaluation will be required.
The report also says no monitoring will be required for the environmental and social indicators but the monitoring of the water structures reliability and safety.
As for protected area, there is no information for Sokuluk-5. However, for other sites, there is a statement that the area of the construction is located within the protected zone.

Table 4-8-1 Findings and Considerations in the Environmental and Social Impact Assessment (Sokuluk-5 Case)

Category	Environmental Item	Items addressed/mentioned/evaluated
0 General Info		・ Capacity = 1.5MW. ・ Population of the village where the project site is located is 3 thousands. ・ Local people mainly work in the agricultural sector. ・ Project area to be cleared is 4.1ha. ・ Transmission line to be built is 200m.
1 Permits and Explanation	EIA and Environmental Permits	・ The environmental and social impact assessment shall be in accordance with the EBRD Environmental and Social Policy (2008). ・ Nothing is stated about Kyrgyz EIA and environmental

9 World Bank (E1985) Kyrgyz Republic Ministry of Energy, Energy Emergency Assistance Project, Environmental Management Plan (2008)

10 Kyrgyz Republic: Strategic Planning For Small and Medium Sized Hydropower Development Phase II- Strategic Planning of Small and Medium HPPs Development Final Report: 4 Pilot Projects Preparation, Mercados (July 2011)

		permits.
	Explanation to the Local Stakeholders	・ Public disclosure has been carried out. ・ Public consultation plan has been developed.
	Examination of Alternatives	・ This report compares four pilot sites. Alternative analysis includes transmission line and access road.
2 Pollution Control	Water Quality	・ No waste water will be generated and discharged. ・ Hydropower plant will use environmentally friendly equipment (water rather than oil will be used to cool down the generator's bearings).
	Wastes	・ All the solid wastes will be non-hazardous wastes. ・ Construction waste will be taken to the solid waste dumps.
	Air	・ The air pollutants to be emitted are listed and their concentrations are calculated.
3 Natural Environment	Protected Areas	・ No information
	Ecosystem	・ Species that may live there are listed. ・ No endemic and Red Book-registered species are found within the construction area. ・ Trees will be cut or uprooted with the minimum damage before construction.
	Hydrology	・ No information in the section of EIA
	Topography and Geology	・ The village will not be affected by the project because of the higher elevations than hydropower plant. ・ The river has mudslide hazards. ・ According to the seismic zoning map of the Kyrgyz Republic, the seismicity of the site of the designed construction is 9 points.
4 Social Environment	Resettlement	・ As the project site is located off the village boundaries, project will not entail any involuntary resettlement or economic displacement. ・ The land plots under the facilities will be leased out on favorable terms.
	Living and Livelihood	・ The village gets water from artesian wells. ・ There are no livelihoods to be compensated within the project site.
	Heritage	・ There are no cultural heritage sites within the construction area.
	Landscape	・ The project site landscaping will be carried out upon the project completion, which includes planting grass, ornamental, fruit, or berry trees.
	Ethnic Minorities and Indigenous Peoples	・ Due to the scope and scale of the project, it will have no negative impact on indigenous people.
	Working Conditions	・ Labor code bans child labor, forced labor and employment discrimination.
5 Others	Impacts during Construction	・ Project impacts (air pollution, dust, noise, etc) over the village will be within the prescribed standards. ・ The plant will provide new job opportunity to the residents. ・ Vehicles and machines will emit CO2.
	Accident Prevention Measures	・ To fence the project site. ・ Employees shall comply with Occupational Health and Safety (OHS) requirements. ・ To ensure the village healthcare facility to provide medical services to the workers.
	Monitoring	・ No environmental and social monitoring will be needed. ・ Only the project will include monitoring of the water structures reliability and safety.
	Impact during operation	・ The plant will provide new job opportunity to the residents. ・ Portable toilet will be used and emptied at the wastewater sewer treatment facilities.
	Preparatory work prior to construction	・ To install amenity buildings. ・ To construct access road and secure the temporary networks for electricity supply, lighting, and water supply.

(Source: Kyrgyz Republic: Strategic Planning For Small and Medium Sized Hydropower Development Phase II- Strategic Planning of Small and Medium HPPs Development Final Report: 4 Pilot Projects Preparation, Mercados (July 2011))

e) Others

Norconsultant conducted the assessment for Shamsi hydropower project and published the report[11]. As the environmental specialist had no opportunity to visit Kyrgyz Republic, he summarized the environmental section by using photos, Google Earth, Internet, and general experience. Therefore, the environmental screening was carried out with limited information as a desk study applying a simplified WB approach. This report covers legal requirements, site characteristics, impact assessment, impact mitigation, and screening results.

With regard to water usage, this report says the planned hydropower facility will utilize some 63% of the total inflow for energy production, whereas some 25% will be lost as flood spill and 12% as mandatory environmental/irrigational release. The river bed will be rendered dry unless ecological releases are made during the period from September to May. A run-of-river type project in a small river like Shamsi will not deteriorate water quality or cause a significant sediment transport in principle. However, changing land use may lead to pollution, localized sedimentation or erosion problems. From the viewpoint of socio-economic environment, no significant negative impacts were predicted.

The study conducted the screening and rated this project as Category B, based on the WB's Environmental and Social Safeguard Policies. This means that a simplified EIA process, which also satisfies the requirements of the Kyrgyz Law on Environmental Impact Assessment, will be carried out during the coming feasibility study phase.

4-8-2 On-Site Investigation Results on Environmental and Social Consideration

The Study Team visited Kyrgyz Republic in February and April, 2013 and had meetings with governmental organizations of Kyrgyz Republic and international donors. (See Photos) The Ministry of Energy and Industry (hereinafter, MEI) and the umbrella organizations provided the Team with various information mainly on small hydropower plants, and additionally explained their needs for supports. As for other ministries besides MEI, for example the Ministry of Agriculture and Land Reclamation explained their request for Japanese energy-effective pumps for irrigation and independent power source necessary in operation of communication equipment at underpopulated area where the village is isolated in the event of disasters. This Ministry has informed JICA of these requests.

[11] Small Hydropower Assessment Shamsi Hydropower Project-Assessment of Feasibility-Draft Report (October, 2012)


Discussion with KSTC on potential sites


Meeting with State department on regulation of fuel-energy complex under MEI


Meeting with a grid Company, JSC NEGK


Meeting with a electricity generation company, JSC EPP


Meeting with JSC Chakan GES
(Small hydropower plants operating company)


Interview with residents at Kegeti Village

Photos 4-8-1 Meetings with Energy Related Entities and Interviews with Local Residents

The Study Team conducted on-site reconnaissance investigations in February and April, 2013. During the winter survey in February, almost no fauna and flora was found except for trees due to snow cover. However, in the survey conducted in April, the Study Team could observe the on-site current situations

including fauna and flora because snow was all melt at the elevation of the targeted sites. As results, the Team recognized that there were totally small number of trees and the biodiversity was low at these sites. No fish was seen throughout the course of all the surveys.
There is possibility of the resettlement and compensation for livelihoods for new construction or rehabilitation sites. However, the number was assumed to be zero to a few, because the scale of a small hydropower project is small.
Summarized in the Table4-8-2 are the results of on-site investigations. This table doesn't cover the sites where the environmentalist didn't conduct the on-site survey.

Table 4-8-2 Keypoints in Environmental and Social Consideration based on On-site Survey

Site	Investigation Period	Environmental Consideration	Social Consideration
New Construction Site			
Kegeti	2013.2 2013.4	・Grid line extension is necessary because the site is far from the existing grid line. It requires the construction work and resources such as metals.	・There is a famous waterfall near the project site in this region. Thus, it is essential to take into consideration the aesthetic viewpoint and discuss it with local residents. ・As the project site is remote from the village, there is few advantage to employ local people preferentially in construction and operation stages.
Alamedin	2013.2		・There are resort facilities including a hot spring facility around the planned project site. Before developing a project, a proponent shall make an agreement with the owners. In addition, they are likely not to live there. Thus, even getting their contact numbers might be difficult.
Shamsi	2013.4	・The report of Norconsult says part of river water should be released for ecological conservation at the intake point. However, as of April 2013, there is no river water in the down-gradient stretch from the planned project area. ・No fauna was observed besides small birds. Species of flora were also simple and not diversified.	・Since there is irrigation channel in the stretch of planned project area, attention for agriculture shall be paid.
Redevelopment of former small hydropower plant sites			
Sokuluk-1	2013.2 2013.4	・The environmental impact of the redevelopment is lower than that of new development, because a part of the existing facility remains. ・There was no river water in the downstream of the planned stretch of the construction (2013.4). ・The biodiversity of flora is poor. ・A proponent shall pay attention for the existing trees residing near the old waterways and facilities as much as possible in designing and construction stages. ・All the old equipment in the existing facility was removed, although the Study	・The representative from the village was cooperative to the small hydropower project. ・There is an intake point for irrigation on the way to the site. ・There is a house next to the old waterway near the former intake facility. ・Other houses are located in the opposite site over the river. ・Land between the river and the waterway is mainly used as pastureland or agricultural land. A slight lot of agricultural land may be affected by the construction work. ・A proponent shall design the waterway so

		Team could not confirm it for a small part. Therefore, solid waste like metals will not be generated in renovation, while the construction waste is supposed to be generated.	that livestock can pass through, because area whose elevation is higher than waterway is also used for pasture area.
Issyk-Ata-2	2013.2		・ There are several resort facilities near the planned project area. Before developing a project, a proponent shall make an agreement with the owners. In addition, they are likely not to live there. Thus, even getting their contact numbers might be difficult. ・ In a partial lot of the old power facility, there is a hotel at present. Therefore, a proponent may negotiate the plan with the right holder.
Djardy-Kainda	2013.4	・ The roof of the building of old power station is made of corrugated slate which may contain asbestos. ・ All the old equipment in the existing facility was removed. Therefore, solid waste like metals will not be generated in renovation, while the construction waste is supposed to be generated. ・ The biodiversity of flora is poor. ・ A proponent shall pay attention for the existing trees residing near the old waterways and facilities as much as possible in designing and construction stages.	・ There are two residential houses in the vicinity of the water discharge point from the power station. However, resettlement may be avoided by the appropriate consideration in the design stage.

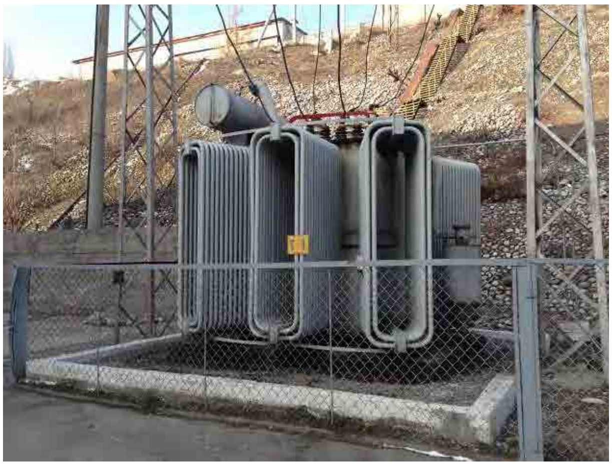
Rehabilitation

Lebedinovka	2013.2	・ The environmental impact of partial renewal of equipment is much lower than that in new construction. ・ The disposal of old equipment will entail waste generation. ・ A transformer may contain trace level of PCBs.	・ The negative impact on the residents residing near the site is considered very low, because the project will be implemented within the existing facility.
Alamedin Midget (For a training center)	2013.2	・ Supposing that the existing facility will be renovated to a training center, the environmental impact will be low.	・ The negative impact on the residents residing near the site is considered very low, because the project will be implemented within the existing facility.

Note: Only special items or comments are shown in the table. General terms are not shown here.

Summarized below are the recognized environmental conditions with the photos taken during the onsite surveys.


Lebedinovka: Water turbine generator left unrepaired. Appropriate actions like recycling of metals shall be taken in the rehabilitation.


Transformer in an operating small hydropower station: The possibility is low that PCBs, hazardous substances, are contained at high concentration because the oil is exchanged periodically.


Sokuluk-1: The species of flora were simple and fauna other than birds was not seen.


Alamedin: A hot spring facility is located next the River. Resort facilities were seen here and there.

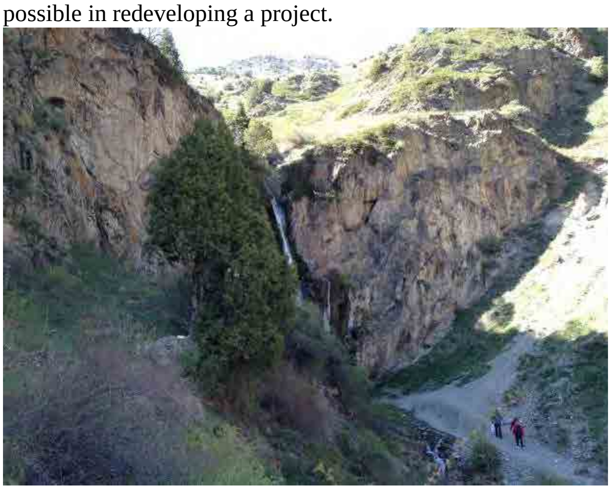

Issyk-Ata-2: A hotel is built at the end of the waterway. It is located in a resort hotel area


Shamsi River: Intake of water using a simple way.

Photos 4-8-2(1) Photos taken during the onsite surveys

Sokluk-1: A tree planted near the old facility seems to be memorial. Thus, protecting the tree will be expected if possible in redeveloping a project.

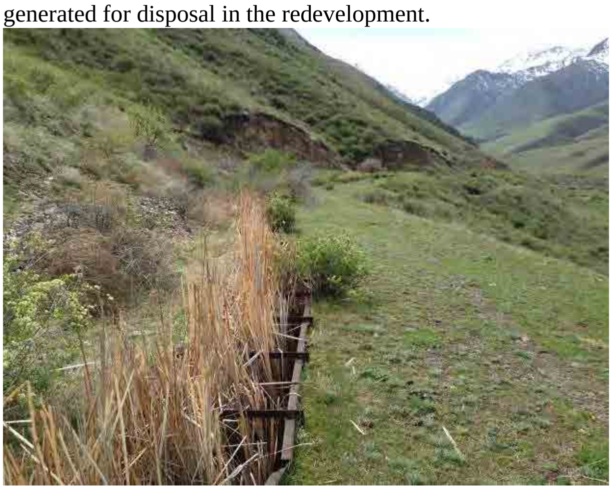
Upstream of Kegeti: There is mudslide risk due to so steep topography.



Kegeti: Waterfall where visitors come for sight seeing. The water flows to Kegeti River.

Djardy-Kainda: The inside of the old power house was vacant. Therefore, no waste of old equipment will be generated for disposal in the redevelopment.

Djardy-Kainda: The roof of the old power house is made of corrugated slate which may contain asbestos.



Djardy-Kainda: Old waterway. Part of the waterway remains as it was.

Photos 4-8-2(2) Photos taken during the onsite surveys

4-9 Summary

The Study Team collected the information on environmental laws and the concerned entities throughout this investigation and summarized them. The Study Team also conducted case studies on EIA by reviewing the reports on environmental and social consideration in the Kyrgyz power sector. On the other hand, the Study Team grasped and recognized the current status and the surrounding environment by the onsite reconnaissance and summed up the key points.
The conclusion is that the environmental and social impact about small hydropower development project is low and limited.
Based on these investigation findings, the draft action items are listed below on the environmental and social consideration that Kyrgyz governmental organizations should implement in the feasibility study phase. However, it should be noted that these listed are common items because the project site has yet to be determined at present.

- Conduct IEE in accordance with the Kyrgyz EIA framework.
- Flora survey by a local specialist
- Discuss and agree on the use of water resource with the Ministry of Agriculture and Land Reclamation.
- Conduct the investigation on resettlement and livelihood. If necessary, draft a plan for the compensation and/or the recovery of livelihood.
- Inventory survey of trees to be cut
- Consultation with local governmental organizations and local residents
- Obtain necessary licenses (Land use, Forestry development, and Use of water resources)

Kyrgyz government has often reorganized the ministries and agencies in recent years. Therefore, the following study shall be done after the reconfirmation of role and responsibility of each organization. In addition, although the laws and regulations are streamlined, the enforcement capacities of organizations are recognized to be a problem. Thus, it should be considered that Japanese government will assist Kyrgyz government to implement the tasks on environmental and social consideration in order to conduct them smoothly.