Asian Development Bank

RETA-6488: CAREC Energy Sector Action Plan

Energy Demand/Supply Balance and Infrastructure Constraints Diagnostics Study

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EXECUTIVE SUMMARY

INTRODUCTION

The Central Asian Regional Economic Cooperation (CAREC) was initiated in 1997 with its members comprising of Afghanistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, People's Republic of China, and Uzbekistan, and supported by an alliance of major multilateral development institutions. The Energy Sector Coordinating Committee (ESCC) – whose priority is to promote efficient and rational use of energy within the region - has agreed on the components of an Energy Action Plan under the framework of CAREC Energy Strategy.

This study (Pillar 1) of the Action Plan involves carrying out a diagnostics evaluation on the energy supply/demand balance and infrastructure constraints, and to identify the status regarding completed, ongoing and planned energy sector projects which will have an impact on the intra-regional power trade capability. Regional dispatch and regulatory development aspects will be covered under Pillar 2; and Pillar 3 will cover issues relating to Energy-Water linkages. This study is to serve as an initial basis for a Regional Power Sector Master Plan for Central Asian Countries and Afghanistan - Regional Technical Assistance (RETA), endorsed by ESCC - to identify the investment needs in generation and transmission in the region.

Four countries are the focus of this diagnostic study - Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan. Each of these countries is served by different portfolios of generation mixes. Because of the different mixes, their availability characteristics, time-value signatures and varying non-coinciding peak demand requirements, there exists significant complementary inter-trade potential between the countries concerned. Increased inter-trade activity would reduce incidences of un-met demand (mainly during winter); conserve and optimize renewable and fossil fuel resources; reduce environmental impacts from emissions, and from water management requirements; and provide each country with increased economic benefits from the above measures. Further economic benefits will accrue due to increased system generation redundancy, a lowering of the need to run fuel costly thermal power plants and a general improvement in the availability of system ancillary services.

This report compiles information and content drawn from primary sources including documents from Government Agencies of Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan as well as from Asian Development Bank (ADB), The World Bank, U.S. Agency for International Development, and observations made during our visits to the countries during the period from June to August 2010. A number of credible Internet related and miscellaneous sources were also consulted.

We would like to thank the Government officials, as well as staff of Kazakhstan Electrical Grid Operating Company (KEGOC), National Electrical Grid of Kyrgyzstan (NEGK), Electric Power Plants Company (EPP), Barki Tojik, Uzbekenergo, Coordinating Dispatch Center (CDC), USAID, AES Company, the ADB and World Bank regional offices and other organizations who shared their valuable insights, understanding and vision for the region with us.

KEY FINDINGS

A. Inter-trade Decline

The fact that power trade between the countries has been in decline since the succession from the Soviet Union lies in general in a combination of the following factors:

a. Technical Barriers: Lack of reliable infrastructure; robust transmission lines and interconnectors; substations; and metering, monitoring and protection systems. Uncertainty over adequacy of fault isolation capability leading to cascade outages inter-regionally. ***(Requires feasibility studies, Technical Assistance and Project Finance).***

b. Commercial Barriers: Differing Power Purchase Agreements between neighboring countries, resulting from differing commercial and strategic leverages; tariff disparities and sub cost-recovery levels; uncertainty over accurate wholesale metering capabilities; uncertainties over invoice / debt settlement; lack of clarity surrounding barter, offset and contra-settlement balancing of imports and exports. ***(Requires negotiation, transparency, fairness and understanding of bi-lateral and regional benefits).***

c. Political Willingness: Lack of enthusiasm to participate in mutually-beneficial trading arrangement sometimes resulting in communication breakdown and a loss of appetite for participation; and internal policies prioritizing self-sufficiency in generation and transmission to the exclusion of adequate consideration of interconnection. ***(Requires negotiation, a buy-in to the concept of bi-lateral and regional benefits, and high-level willingness to participate in regional economic improvement. This is the key catalyst and enabler which must first occur before the barriers at (i) and (ii) above can be effectively addressed).***

B. Projects Progression

There has been significant progress achieved in the four member countries which fall within the brief of this study. Projects that have been implemented, or are underway, or are in the planning stages, generally are physical (infrastructural) in nature and belong to one of the following type-sets:

(i) Generation projects from 10 MW to 4000 MW have been identified, many using renewable energy resources which are prevalent especially within Tajikistan and Kyrgyzstan.

(ii) Transmission infrastructure projects, at 110 kV but particularly 220 kV and 500 kV to facilitate meaningful power inter-trade.

(iii) Substation and switchgear rehabilitation, wholesale metering, protection systems, and reliability improvements.

(iv) SCADA systems, telemetry, and functionality of National Dispatch Centers.

A detailed projects list is presented in Activity Matrix (Appendix 1).

Number of projects include components addressing non-physical aspects of power sector, i.e. performance improvement and commercialization of the generation, grid and distribution companies (state or private) within each country. Non-physical aspects include everything from utility operational efficiency benchmarking, transmission and dispatch loss reduction, commercial losses control, effective billing and collections, management process optimization and corporate governance.

It is essential that the CAREC members achieve improvements in the above areas, in addition to achieving adequate cost recovery in the form of realistic tariffs, in order to enable appropriately-priced long-term Power Purchase Agreements (PPAs) to be available. This is necessary in order to attract private sector investment in to tap the abundant potential of renewable energy generation potential. This will enable energy and energy derivatives to become the primary export commodity for the CAREC members thereby catalyzing significant economic growth.

C. Gaps & Overlaps

A number of over and under-concentrations of effort exist and unless identified and rectified these will lead to lost opportunities (arising from gaps in pipeline projects) and cost inefficiencies (arising from duplication of effort via overlaps). In general these can be summarized as follows –

1. Several International Financing Institutions are examining – sometimes simultaneously – areas within the Demand Side Management sector, such as electric load displacement; energy efficiencies; and building standards (energy). There should be greater coordination of effort here.

2. Many areas require coordinated effort and attention now if they are to avoid becoming critical path issues during future projects and efforts at increased power inter-trade. These include:

    (i) National Dispatch Centre demand loads are being fed to the Regional Dispatch Centre in Tashkent ("Coordination Dispatch Centre" - CDC) from member countries, but many key loads are not being properly measured or the data is not properly transmitted to the CDC.

    (ii) The CDC receives data acquisition streams from the Central Asian countries but presently has little or no supervisory or load / generator dispatch functionality.

    (iii) There are many potential HPPs in the region in the scale-range of 10 – 30 MW which seem feasible but presently lack financing prospects. These should be examined again and prioritized for finance.

    (iv) Several internal 220 and 500 kV transmission backbone and ring-main lines are being constructed in the interests of self-sufficiency with inadequate attention being paid to their integration into a regional power network in time.

    (v) Inappropriate industry structures pose a significant barrier to the development of regional power trade. If the transmission company and some

generators are government-owned, it seems unlikely that cheaper power will be imported from abroad while local generators remain idle. Regional energy trade will therefore require the commercial interests of the transmission companies and their managers to be completely separated from those of the generators.

(vi) Inappropriate tariff setting due to the subsidized gas price in the case of some Central Asian countries results in thermal generation becoming competitive with hydro generation from HPPs. This distorts free market activity and beneficial regional trade.

NEXT STEPS

This study will lead into the production of two major master plans:

1. Regional Power Sector Master Plan for Central Asian countries, which will tie in with
2. A simultaneous Power Sector Master Plan for Afghanistan.

These master plans will identify the investment needs in generation and transmission assets in the area, and prioritize these according to seasonal supply-demand balances; transmission constraints; intra and extra-regional power trade opportunities, and overall least-cost infrastructure investment planning options.

Both these studies are expected to have the consultants appointed and ready to commence by end of 2010 with a view to completion by end of 2011.

1. SECTOR OVERVIEW

1.1. BACKGROUND

The integrated power system of Central Asia was designed during the Soviet time to balance the unequal geographical and seasonal spread of hydro and thermal fuel resources within Central Asia. During the Soviet era it was technically and operationally optimal, and adequately catered for fluctuating demand requirements, in addition to frequency needs and water/energy balances, and as a single, whole borderless power system with approximately thermal power plant (TPP) 70 % and hydro power plant (HPP) 30% was controlled from a center in Tashkent. During this period, Regional cooperation accommodated regional variations, differing thermal/hydro generation stock mixes, and surpluses and deficits resulting from the above in addition to agricultural and seasonal demand/supply requirements. Kyrgyzstan and Tajikistan received extra fuel in the winter to feed their power plants, and saved the water in reservoirs to be released in the summer for irrigation in Uzbekistan and Kazakhstan. The summer surplus electricity flowed to Kazakhstan and Uzbekistan. In effect the HPP reservoirs were utilized as a main priority to optimize the irrigation flow requirements of the downstream countries. To achieve this balancing, the Unified Energy System of Central Asia (UESCA) was built based on a 500 kV transmission system that connects Kyrgyzstan, Uzbekistan and southern Kazakhstan and includes inter-connecting lines into Tajikistan and Turkmenistan.

Today, UESCA is continued to be coordinated by the regional dispatching center located in Tashkent, Uzbekistan which is now called the Coordination Dispatch Centre "Energia".

1.2. TRANSITION TO INDEPENDENT REPUBLICS – REGIONAL OVERVIEW

However since the establishment of the Central Asian Republics in 1990, the independent countries each headed towards a target of individual self-sufficiency. This resulted in a collapse in Regional Power trade from 25 TWh in 2000 to 3.7 TWh in 2008.

Thus, Kyrgyzstan and Tajikistan are now heavily dependent on hydro resources for their energy needs, having over 90% of their electricity production based on hydro. In order to ensure maximum energy supplies are available during the winter season when glacial river melt-waters flows are minimal, it would at first appear logical that summer water releases are minimized to conserve water and retain reservoirs for winter power-generation related release. However given that that water resources, which are the main source of energy in these up-stream countries, are of vital importance for irrigation in downstream countries – Uzbekistan and Kazakhstan, the result today is that there exists a conflict of interests between the upstream and downstream countries which still remains beyond effective resolution. An effective response to the situation requires, above all, a careful analysis of the nature of the problem and of the past and present efforts of national governments to address the issue.

The reality is that the two requirements are for the most part non-coincidental – peak water requirements for irrigation are during summer-time, whereas peak power requirements which demand water release from upper reservoirs are during winter-time, a fact which is much more pronounced if there is a lack of interconnection from neighboring countries with hydrocarbon-fired power plant. Pillar 3 of the Energy Action plan is looking at this water-

power interaction in order to refine models and analysis tools, and effect capacity building and institutional strengthening.
Whilst Tajikistan and Kyrgyzstan share a similar dependence on hydro-energy, Kazakhstan, Uzbekistan and Turkmenistan possess alternative fossil-fuelled energy-generation sources. These three countries could be in a position to supply guaranteed volumes of electric power in mutually-beneficial agreements reciprocated by agreements to supply summer irrigation water and cheaper hydropower thereby displacing thermal plant usage (fuelled by increasingly valuable gas). However no such agreement exists in any reliable, long-term or otherwise firm basis. The fact that no firm trade agreements exist is further compounded by Central Asian states for the most part diminishing and isolating (rather than increasing and extending) the degree and capacity of interconnection between one another. The net result is that electricity supplies within Tajikistan and Kyrgyzstan in particular are unreliable, intermittent and prone to both scheduled and unscheduled outages, especially in regions remote to the main centers of power generation. Furthermore the depleted energy infrastructure and lack of effective management especially in Kyrgyzstan and Tajikistan has highlighted in recent years the near-catastrophic state of the energy production and supply sectors. The economies of these two countries remain in a depressed state, especially after the energy crisis in 2008 and 2009 threatening social discontent in already unstable societies.

It should be pointed out that the reducing number of interconnection points, together with the scarcity of firm power inter-trade agreements, is not just negatively affecting those upstream hydro-dependant countries, but also reduces the availability of valuable peak-demand driven capacity requirements in downstream countries, forcing these too to either carry out load-shedding activities or dispatch onto the grid expensive thermal peaking plant where these are available. Also it results in a deficit of ancillary services to the downstream countries, in that the interconnections provided frequency regulation and black-start capabilities to the grid as a whole.

As realization grew within CARs that the IPS was failing functionally (due to a mix of technical, commercial, and political reasons), self-sufficiency was required internally within each nation to satisfy economic, political, and commercial rationale.

However it must be pointed out at this stage that whilst the drivers for self-sufficiency are largely driven by deficiencies in the power inter-trade market, nonetheless aspirations of self-sufficiency are not necessarily ill-conceived once they are seen and approached as a stepping stone to regional interconnection. At least, aging power infrastructure must be renewed or rehabilitated before countries networks can form a reliable part of a regional ring-main transmission system. Also greater self-sufficiency can be a good place from which to negotiate equivalence in commercial transaction agreements – a weak or needy participant may well have undue leverage imposed on them due to having a weaker starting position, i.e. forced to import or export power under less than fair terms.

1.3. DECLINE IN INTRA-REGIONAL ELECTRICITY TRADE

Due to lack of cooperation between the Central Asian Republics (CAR) and their focus on self-sufficiency electricity trade among the countries has been declining in the past years leading to lost economic opportunities and mutual benefits. The following tables summarize the power import/export balances per country over the last 10 years.

Table 1. Dynamics of Electricity Imports/Exports between CAR, 2000-2008 (GWh)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	Cummulative 9 years	9 year Average
KAZ	Import	1,287.7	1,273.1	603.7	1,748.5	3,224.5	2,736.6	2,260.1	1,401.7	768.2	15,304.1	1,700.5
	Export	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.1	21.1	2.3
	Balance	-1,287.7	-1,273.1	-603.7	-1,748.5	-3,224.5	-2,736.6	-2,260.1	-1,401.7	-747.1	-15,283.0	-1,698.1
KGZ	Import	320.3	321.7	429.7	107.9	60.9	3.5	10.1	3.4	102.3	1,359.8	151.1
	Export	3,332.9	2,379.8	1,209.6	1,933.6	3,553.2	2,898.1	2,681.2	2,576.4	866.1	21,430.9	2,381.2
	Balance	3,012.6	2,058.1	779.9	1,825.7	3,492.3	2,894.6	2,671.1	2,573.0	763.8	20,071.1	2,230.1
TAJ	Import	1,701.9	1,683.1	1,051.5	1,061.4	1,080.7	1,045.0	1,556.9	1,057.1	1,917.2	12,154.8	1,350.5
	Export	369.6	333.8	266.1	1,017.1	693.7	755.5	900.0	904.2	994.7	6,234.7	692.7
	Balance	-1,332.3	-1,349.3	-785.4	-44.3	-387.0	-289.5	-656.9	-152.9	-922.5	-5,920.1	-657.8
UZB	Import	2,237.2	1,349.8	607.9	808.0	639.7	683.5	900.0	1,775.9	925.7	9,927.7	1,103.1
	Export	955.9	855.9	631.3	779.7	759.3	815.4	1,146.5	614.7	631.5	7,190.2	798.9
	Balance	-1,281.3	-493.9	23.4	-28.3	119.6	131.9	246.5	-1,161.2	-294.2	-2,737.5	-304.2
TKM	Import	32.5	0.1	6.6	5.4	0.4	0.4	0.5	0.4	0.7	47.0	7.8
	Export	921.2	1,058.3	592.4	0.8	na	na	na	143.3	1,200.7	3,916.7	652.8
	Balance	888.7	1,058.2	585.8	-4.6	na	na	na	142.9	1,200.0	3,871.0	645.2
	Total Import	**5,579.6**	**4,627.8**	**2,699.4**	**3,731.2**	**5,006.2**	**4,469.0**	**4,727.6**	**4,238.5**	**3,714.1**		
	Total Export	**5,579.6**	**4,627.8**	**2,699.4**	**3,731.2**	**5,006.2**	**4,469.0**	**4,727.7**	**4,238.6**	**3,714.1**		

Source: Coordinating Dispatch Center (Tashkent)

Table 2a. Regional Electricity Trade, 2000-2008: 9 year trade totals between the countries (GWh)

		IMPORTS				
		KAZ	**KGZ**	**TAJ**	**UZB**	**TKM**
EXPORTS	**KAZ**		0	21	0	0
	KGZ	14,780		2,007	4,643	0
	TAJ	626	564		5,045	0
	UZB	0	796	6,347		47
	TKM	80	0	3,799	58	

Note: KAZ exports also include electricity for further re-export to Russia
Source: Coordinating Dispatch Center (Tashkent)

Table 2b. Regional Electricity Trade, 2000-2008: 9 year averages between the countries (GWh)

		IMPORTS					TOTAL EXPORTS	NET EXPORT
		KAZ	**KGZ**	**TAJ**	**UZB**	**TKM**		
EXPORTS	**KAZ**		0	2.3	0	0	**2.3**	**-1,718**
	KGZ	1,642		223	516	0	**2,381**	**2,230**
	TAJ	70	63		561	0	**693**	**-658**
	UZB	0	88	705		5.2	**799**	**-284**
	TKM	9	0	420	6.5		**435**	**430**
TOTAL IMPORTS		**1,721**	**151**	**1,351**	**1,083**	**5.2**	**4,311**	**0**

Note: KAZ exports also include electricity for further re-export to Russia
Source: Coordinating Dispatch Center (Tashkent)

As the decline in intra-regional trade (which smoothened demand/supply imbalances) gained pace, and the rapidly deteriorating condition in electrical infrastructure began to take effect, and poor management of the power systems, Tajikistan and Kyrgyzstan experienced severe electricity shortage during the winter in the beginning of 2008. In both countries' main reservoirs the level of water dropped critically. The Government introduced restrictions on energy supply for all consumers and tariffs were increased.

Both countries experienced serious levels of un-scheduled and planned outages in winter of 2008/09 with many areas receiving less than six hours of supply per day despite active load-shedding measures. Water levels especially in Toktogul reservoir remained very low in again 2009. Officials explained the main causes of such crisis by "abnormally cold" winter of 2007-2008 and the cycle of dry years. However, many independent analysts and political opposition cited mismanagement and corruption in the sector. The availability and cost of electricity caused untold social and economic hardship, with the politics of energy supply and demand in Kyrgyzstan contributing to recent social unrest there.

Ineffective inter-governmental agreements

In the past years, the national governments have not demonstrated strong ability to negotiate effectively. Most of the agreements between the Central Asian governments proved ineffective, and instead the countries have opted for annual bilateral agreements.

Some promising step forward was made in October 2008 in Bishkek where the leaders of the Central Asian states agreed in principle on certain cooperative measures to alleviate the impact of water and energy deficit in 2009. The inter-governmental protocol established parameters for joint water and energy supply during the 2008-09 winter (heating season) and the 2009 summer (vegetation season). The Kyrgyz government agreed that by the beginning of the vegetation period of 2009, the volume of water in the Toktogul reservoir would be no less than that of 2008. Uzbekistan and Kazakhstan, as recipients of water from this reservoir, in their turn agreed to supply some gas, additional electricity, and coal and purchase up to 1.2 TWh of electricity from Kyrgyzstan during the summer of 2009. Tajikistan, Uzbekistan, and Turkmenistan also reached agreements regarding the use of water from the Nurek water reservoir, and on supplying Tajikistan with gas. However, this agreement as many other such multi-party agreements was not effectively implemented.

Even though the progress so far remains poor, the vast majority understands that there is no alternative to regional cooperation on these major issues.

1.4. ELECTRICITY PRODUCTION & SUPPLY/DEMAND BALANCE

Total installed capacity of the four CARs stood over 40,000 MW at the end of 2009, including 11,730 MW of hydro power (28%) and 29,768 MW of thermal power (71%) as shown in Table 1 below.

Despite the fact that Regional total available capacity is higher than peak demand, supply of electricity, especially in Kyrgyzstan and Tajikistan, remains unreliable, due to seasonal change of water levels, less available capacity in winter times, and restrictive functioning of water reservoirs due to irrigation needs. Additionally the total installed capacity in any country is rarely if ever available due to the unreliability of aging, poorly maintained plant.

Table 3. Installed Capacity and Supply/Demand Balance in CAR in 2009

	Kazakhstan	*Kyrgyzstan*	*Tajikistan*	*Uzbekistan*	*Total*
Installed Capacity HPP, MW	2,264	2,950	5,024	1,810	11,730
Installed Capacity TPP, MW	16,920	730	318	10,643	28,768
Total Installed Capacity, MW	19,184	3,680	5,024	12,453	40,341
Available Capacity, MW	13,058	3,220	4,070	8,750	30,640
Peak Demand, MW	13,500	2,800	3,225	7,900	29,250**
Total Production, GWh	80,074	10,470	19,922	50,250	160,716
Export, GWh	88	964	1,158	394 ***	2,604
Import, GWh	1187	0	1,276	925	3,388
Gross Domestic Supply, GWh (2008)	80,840	11,234	21,891	49,955	163,960
Net Domestic Supply, GWh	64,000*	8,400	13,140	34,995 *	120,535
Losses, GWh (T & C)	21%*	2,834 (27%)	8,756 (40%)	(30%)*	29% avg.
National Annual Load Factor	70%	37%	70%	65%	57% avg.

Source: Consultants calculations on data from various sources, such as MINT Kazakhstan; MOE Kyrgyzstan; Barki Tojik Tajikistan; UzbekEnergo, Uzbekistan; ADB; USAID and US Foreign Commercial Service; World Bank, and International Energy Agency. Due to a lack of data received from the countries, in some cases it has been necessary to utilize data from differing years (e.g. 2008, 2009). Additionally it has been necessary to rely on different sources of conflicting data, again as responses were not received to power sector information requests to the countries concerned.
** Estimated or derived from indicative data, due to lack of information from country.*
*** If the peaks demands were coinciding, this is highly unlikely to be the case*
**** In 2009 Uzbekistan additionally exported also to Afghanistan 542 GWh.*

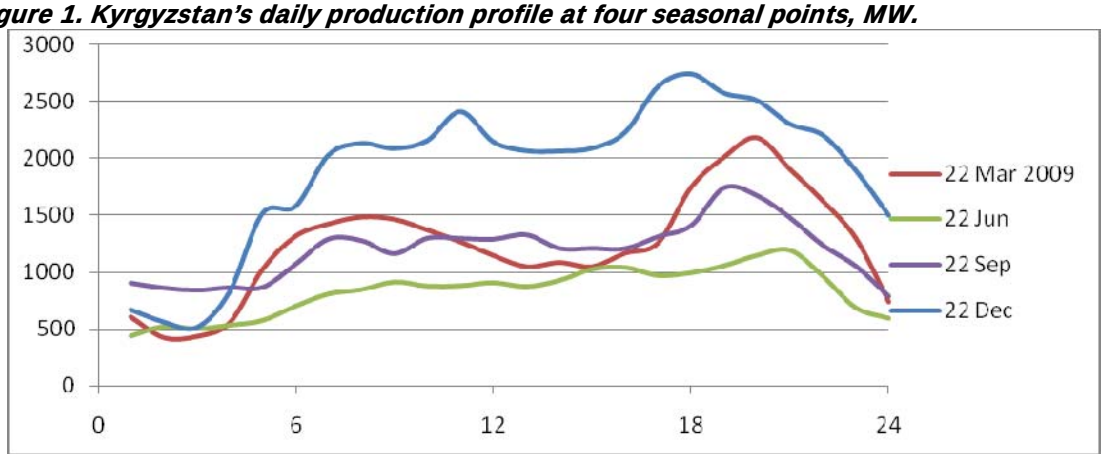
1.5. COUNTRY SECTOR OVERVIEW

2.5.1 KYRGYZSTAN

KEY STATISTICS		
		Source
2009 Production 2009 Consumption	10.47 TWh 8.4 TWh	NEGK
Installed capacity	3,680 MW	MOE
Peak Demand	2,800 MW	ERRA
Surplus Export over Import	964 GWh	NEGK
Hydro	94%	MOE

The following chart shows daily production profile for representative dates.

Figure 1. Kyrgyzstan's daily production profile at four seasonal points, MW.



Source: Electric Power Plants Company, Kyrgyz Republic

Key issues in the sector

Tariffs. Tariffs are set by the government and so far have been regulated inefficiently and unpredictably. For instance, the government doubled the electricity tariffs from 1 January 2010 in one step in order to bring them in line with cost recovery levels, however due to social tension and political instability (forceful change of the government on 7 April 2010), the tariffs were brought back to their previous levels by the new government. Such situation and low level of tariffs also effects negatively on the financial position of the company. Thus, NEGK is facing difficulties to fulfill its current debt obligations due to weak financial position and poor financial management. Overall, this situation can change only with improved management, more professional financial management of the company and overall improvement of government's policy and regulations.

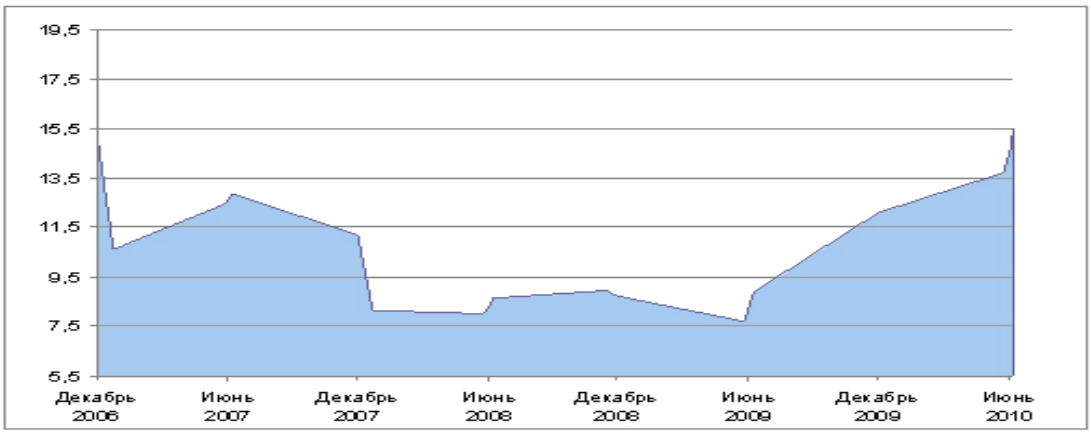
High losses of electricity. NEP "National Energy Program of the Kyrgyz Republic for 2006-2010 and the Strategy of the Fuel and Energy Complex until 2025" (NEP)P adopted in 2006 stated that the total losses in the electricity system had been over 40% and out of which 25% is commercial losses and thefts. In 2007 the losses were 2.1 billion kWh that is 38.2% of the production.

2008 Energy Crisis.

As indicated above, Kyrgyzstan experienced large electricity shortage in winter in early 2008. Then by spring time, the level of water in the country's main reservoir dropped critically. This affected the operation of the country's major cascade of HPPs located below this Toktogul reservoir. The Government introduced severe restrictions on energy supply for all consumers and tariffs were increasing.

Since the water/energy shortage crisis the public has also been keen in observing level of water at the Toktogul reservoir. News agencies in the country regularly publish information on this water level as well as related water inflows and outflows. News in July 2010 said that the reservoir was at about full capacity (19.5 bcm) and the country started electricity exports to Kazakhstan.

Figure 3. Dynamics of water level at the Toktogul reservoir during 2006-2010, in bcm.



Source: Ministry of Energy, Kyrgyz Republic

Current infrastructure constraints

Over 90% of Kyrgyzstan's energy is generated from hydro resources in the south, whilst the major consumption is in the north. There is only one 500 kV transmission line connecting the Toktogul HPP in the south with the north of the country. The other four hydro power plants in the Naryn Cascade are connected to the 220 kV grid located in the Fergana part of the Uzbek energy system.

The main structural weaknesses in Kyrgyzstan's transmission scheme, which put at risk the system's ability to deliver reliable power throughout the country, are as follows:

- A single 500 kV transmission line connects South (major hydropower plants) to North (major load centers including capital Bishkek). If this line goes out, the north would be mostly dark unless neighbors were able to supply and willing to deliver sufficient replacement power.
- Delivery of power to the North is constrained by the throughput capacity of the 500kV substation Frunzenskaya in the north. This substation can allow no more than 860 MW into the north without using lines that go through Uzbekistan and Kazakhstan, whereas Toktogul HPP installed capacity is 1,200 MW.
- The Country does not have direct control over power supply to the south. To supply the south, power mainly flows from the Toktogul HPP and other HPPs of the Naryn Cascade first to the 500 kV Lochin substation in Uzbekistan and then it returns to southern Kyrgyzstan on 220 kV lines from Uzbekistan. So, the supply to the south is at risk as Uzbekistan has threatened to withdraw from the Central Asian Power System and disconnect the Kyrgyz from the Lochin substation.

Thus, the current energy transmission capacity and configuration is insufficient to carry the available generation capacity from Kyrgyzstan's existing HPPs throughout the country. There also is insufficient reliability criteria built into the existing 220 kV transmission network; transmission capacity schemes of the HPPs do not presently meet N-1 reliability criteria: if one line goes out of service, then generation must be curtailed. That is why the current configuration of transmission capacity makes it difficult to develop the prospects for a power market in which Kyrgyzstan could market and sell its energy resources to other countries.

Kyrgyzstan's investment plan for self-sufficiency

Any possible break up of Uzbekistan from UESCA can cause adverse effects on Kyrgyzstan's ability to supply both the north and the south of the country.

To remedy the weakness described above, Kyrgyzstan is considering investments estimated $586 million for the following new substation and transmission lines: (i) the Datka-Kemin 500 kV line and Kemin substation ($330 million), and (ii) the Datka substation and new 220 kV lines in the south ($256 million).

These investments would also allow Kyrgyzstan to improve reliability of supply to its regions as well as to give redundancy to the regional transmission system of UESCA.

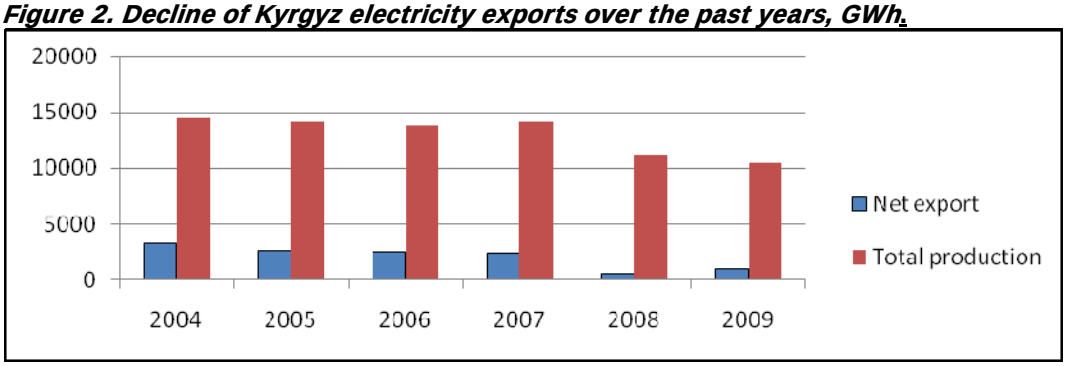
Regional issues and decline in electricity trade

The country's strategy document states that at present there is no coordinated long-term policy among Central Asian countries on usage of water-energy resources in the region, and that this causes competitive behavior between the countries rather than cooperative that would allow optimal usage of the resources.

Due unsolved issues on accumulation, storage and delivery of water during vegetation, Kyrgyzstan is facing large financial difficulties for maintenance of its hydro-technical complexes. High dependence on hydro energy and imports of oil puts threat of energy supply failure to the national economy during dry years and unstable oil prices. The country imports over 90% of needed petroleum products." According to one of the senior Kyrgyz government representative, "Uzbekistan and Kazakhstan should understand that Kyrgyzstan needs money to maintain the reservoirs to provide with irrigation water".

Kyrgyzstan's electricity trade with the region (net exports) has been in decline in the past years as shown in the chart below.

Figure 2. Decline of Kyrgyz electricity exports over the past years, GWh.



GWh	2004	2005	2006	2007	2008	2009
Net exports	3,270	2,635	2,460	2,379	552	964
Total electricity production	14,503	14,196	13,868	14,203	11,247	10,474

Source: NEGK

Government's Electricity Sector priority investments include the following:

- Completing on-going construction of Kambarata 2 HPP (360 MW) – the first of three was commissioned in August 2010;
- 110 kV substation and OHTL "Aigultash-Samat" in South Kyrgyzstan (Batken Oblast); its commenced is planned for November 2011;
- 500 kV Substation "Datka" near Jalal-Abad town in South Kyrgyzstan and reconstruction of related 220 kV transmission lines – a 3 year contract has been

negotiated with a Chinese company "TBN Electric" (Project cost $256 mn); This will allow to pass the energy from lower Toktogul cascade to pass directly to S/S Datka [instead of passing the energy first to Uzbekistan (SS Lochin 500 kV) and then from there to Southern Kyrgyzstan];

- Transmission line "Datka-Kemin" (410 km) and SS 500 kV "Kemin" to allow transmission of electricity to North Kyrgyzstan thus enforcing the supply of the North and also being less dependent on CAPS loop 500 kV. The route considered is: SS Datka-Kambarata2 HPP-Kambarata1 HPP-Naryn Oblast-Chui Valley-Kemin town. Agreement has been signed with China (under mechanisms of the Shanghai Cooperation Organization). The construction is to be commenced in 2011 and to be completed in 4 years. Estimated Project cost is $330 mn;
- Transmission lines to be built under the CASA-1000 Project in order to transmit power from Central Asia to South Asia in the amount of 1000 MW initially. This is to promote development of the broader regional electricity market;
- Improvement of the distribution network of Bishkek city in order to reduce high losses of Severelectro distribution company – KfW is considering 29.5 mn Euros to support this;
- Kara-Keche Heat Power Plant (over 800 MW) near coal deposit in the Naryn Oblast. This would allow supporting Bishkek TPP during winter time and reducing costs on imported coal and gas. Estimated cost is $2.3 bn with implementation period of 4 years;
- Transmission metering improvement project. Estimated cost of $56 million and expected to be financed by ADB;
- Kambarata 1 HPP (1900 MW) with possible participation of Russia;
- Rehabilitation of Bishkek THP (2 bn Som, i.e. c. $50m.) and Uch-Kurgan HPP (615m Som, i.e. c. $15m.) – to be financed from own resources of respective companies and funds of State Investment Program;
- Investments (about 10 bn Som, i.e. c. $200 m) to upgrade distribution networks in order to reduce losses;
- Development of renewable energy resources, including small hydro, wind and solar power up to 250 MW; Development of small HPPs to start with those on the Kirov, Orto-Tokoi and Papan irrigation dams.

The two Kambarata plants are to have annual generation capacities of 5,100 million kWh and 1,100 million kWh, respectively, and would allow controlling all of the Naryn River output, which makes them even more important in terms of flood control and better delivery of irrigation water to Uzbekistan. Lawmakers in Kyrgyzstan understand that foreign direct investment is needed in order to achieve infrastructure improvement. The problem seems to lie at turning over the installations to business consortium and meeting the conditions of such consortium. According to the law on "Special Status of the Cascade of Toktogul Hydro Power Plants and the National Electric Network" both Electric Power Plants Company (EPP) and National Electrical Grid of Kyrgyzstan (NEGK) are prohibited from being sold or expropriated in any other form. In May 2008, the Kyrgyz parliament adopted amendments to the law, taking the Kambarata power plants and the Bishkek thermo-electric plant out of the list of "cascade of Toktogul hydro power plants", thus making their privatization possible.

This ambitious program of the government - listed in National Energy Program (NEP) - needs substantial investment. Based on the given cost estimates as above, a total of $918 million is needed just for new HV transmission lines and substations both to secure domestic supply and to enable the export of surplus power to the regional markets.

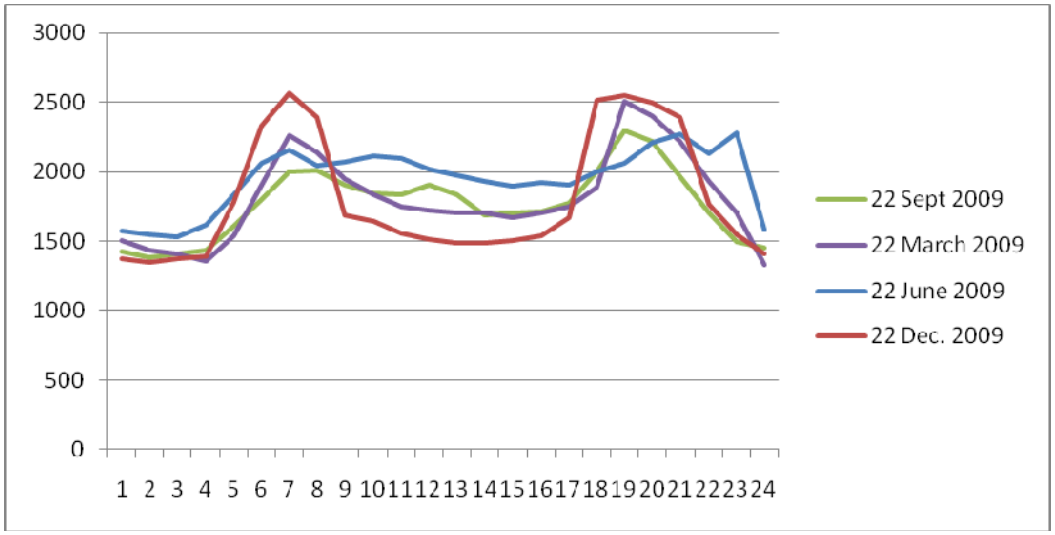
2.5.2 TAJIKISTAN

KEY STATISTICS, 2009	
Consumption	13.1 TWh
Installed capacity	5,024 MW
Peak Demand	3,225 MW
Min. Demand	-
Fossil Fuel	4%
Renewable (Hydro)	96 %

Source: Barki Tojik

The following table shows daily demand profile for summer and winter representative days.

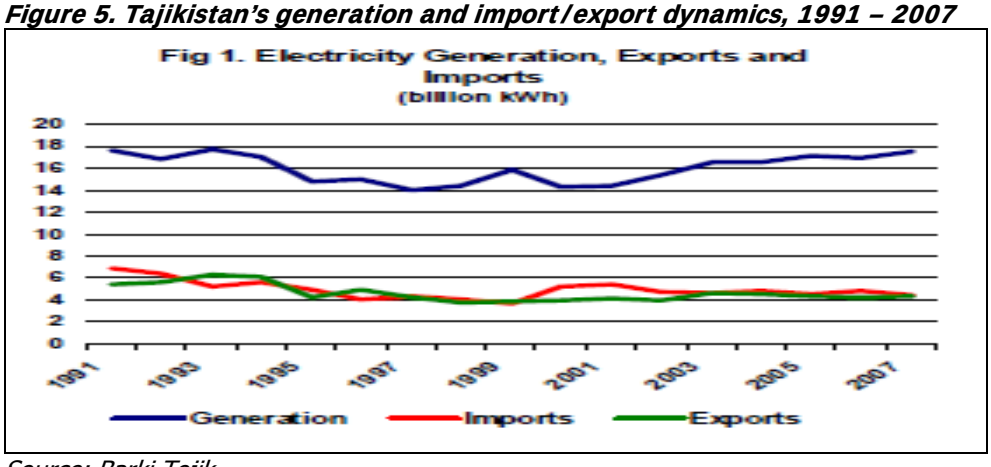
Figure 4. Tajikistan's daily production profiles for winter/summer representative dates



Source: Barki Tojik

The following graph demonstrates the total generation, imports and exports over the previous eighteen years in TWh.

Figure 5. Tajikistan's generation and import/export dynamics, 1991 – 2007



Source: Barki Tojik

Tajikistan – Self Sufficiency

A current major problem facing the grid operator in Tajikistan is that Uzbekistan switched off from parallel operation with Tajikistan within UESCA in December 2009. Due to an inability to exporting significant quantities of power to Central Asian countries, Tajikistan is forced to spill off significant amount of summer water without production of electricity. Up to 3 TWh is spilled during the summer. This equates to a national economic revenue loss of about $60 million at current approximate average unit price (AUP) of $0.02 per kWh. Despite various suggestions to save such losses, there has been no positive decision on allowing Tajikistan to join UESCA again. Experts believe this is purely political undertaking. This is a huge loss to region that is caused by lack of regional cooperation.

As to Uzbekistan, it is now independent from the Tajikistan system after it has developed its internal power system. The frequency (power) regulations that Tajikistan provided now can be made solely by Kyrgyzstan.

In June 2010 during the meeting of Coordination Dispatch Center of Central Asia, Kazakhstan, Uzbekistan, Kyrgyzstan, and Tajikistan discussed possibilities to restore "parallel work" of UESCA to allow transits and exports for each other. In order to allow Tajikistan back into the system Uzbekistan remains to agree, since all decisions are made on consensus. In particular, it was indicated informally during the meetings that if outstanding debt of Tajikistan relating to Uzbekistan's exports to the Rudaki 220 kV SS was cleared, it would become easier to agree to restore the parallel work and allow power flow to the Asht 220 kV SS in Northern Tajikistan.

First Deputy Minister of Energy and Industry of Tajikistan participated in Energy Sector Coordination Committee meeting at ADB office in April 2010 and described other priority activities and projects including the following:

- At present, approximately 600 GWh per annum is being sold to Afghanistan based on a 25-year agreement at the rate of not more than 3.5 cents per kilowatt hour;

- EBRD is interested in rehabilitation of Kairakkum HPP and installation of electrical meters in Khujand.

- Proposed CAREC Regional Power Rehabilitation Project with estimated cost at about $141 million. The outputs of the project will include: (i) construction of 220 kV Kairakum-Asht transmission line, and rehabilitation of Kairakum 220 kV substation, with an additional one new bay in Asht 220 kV substation; (ii) construction of 220 kV Geran-Rumi transmission line, rehabilitation of 220 kV Rumi substation, and rehabilitation and expansion of 220 kV Geran substation; (iii) rehabilitation of Regar 500 kV and Baipaza 220 kV substations; (iv) installation of Supervisory Control and Data Acquisition (SCADA) System at national control center and 32 key substations; and (v) institutional strengthening and capacity building for Barki Tojik.

- Chinese Government provided a concessional loan amounting to $ 373 million on construction of 220 kV "Lolazor-Khatlon" transmission line (90 km) and 500kV "South – North" transmission line (350 km). Chinese company TBEA has signed an agreement with Tajikistan on establishment of Dushanbe Thermal Power Plant-2.

Table below shows other major investment projects (completed or under preparation) in Tajikistan.

Table 5. Energy projects currently at preparation stage Tajikistan.

Project Name	***Estimated project cost, million USD***
Power Sector Rehabilitation Project (Financed by: ADB, IDB, Swiss Government, BT)	69.3
Reconstruction of Electricity Network of Dushanbe (Kuwait Fund, BT)	15.7
Small HPPs at villages (IDB, BT)	11.6
Regional Power System (ADB, OPEC, BT)	54.0
Construction of 500 kV TL "South-North" (Eximbank China, BT)	281.3
220 kV TL "Hatlon-Lolazor" *110 kV TL "Hatlon-Lolazor"* (Eximbank China, BT)	58.1 8.6
Sangtuda 2 HPP (220 MW) (Iranian Development Bank, BT, Tajik Government, Sangob Company)	256
Electricity Loss Reduction Project (IDA, Swiss Government, BT)	17.15
Rehabilitation of outdoor switchyards 500 kV and 220 kV at Nurek HPP ($ 67 mn and 25 mn Euros respectively)	100
Rehabilitation of equipment at Baipaza HPP	1.7
Modernization of Golovnaya HPP	14
Modernization of Varzob HPP	17
Modernization of Kairak-Kum HPP	127
Total projects amount	***1,085***

Source: Barki Tojik

2.5.3 KAZAKHSTAN

KEY STATISTICS	
2009 Consumption	78 TWh
Installed capacity	19.1 MW
Peak Demand	13,500 MW
Surplus Export over Import	474 Gwh
Fossil Fuel	91.3%
Renewable (Hydro)	8.7%

Source: KEGOC, Energy Regulators Regional Association

Electricity generation companies consisting of 63 power plants of different forms of ownership with total generation installed capacity in Kazakhstan is 19,184 MW. However, the available capacity is some 13,058 MW as of June 2010. Over 85% of electricity is generated at Thermal Power Plants as shown in the table below.

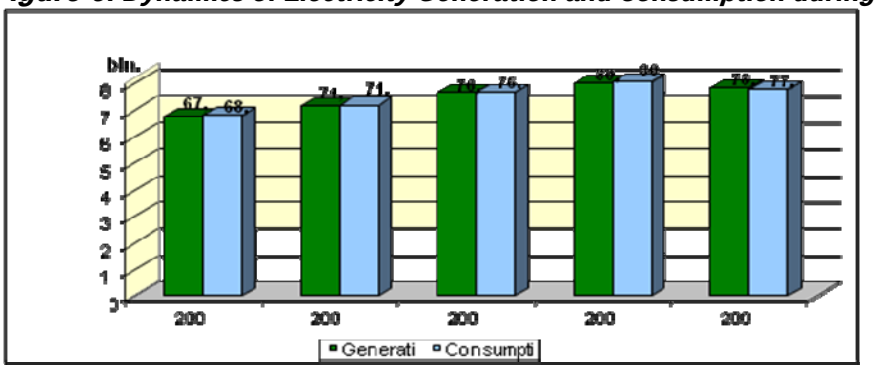
Table 6. Electricity generation structure in Kazakhstan in 2009

	2009
Including Thermal Power Plants	85.5%
Hydro Power Plants	8.8%
Gas-Turbine Power Plants	5.7%
Total	***100.0 %***

Source: KEGOC

Annual national generation is approaching closely 80 TWh. Generation and consumption dynamics are represented in the figure below.

Figure 6. Dynamics of Electricity Generation and Consumption during 2005-2009, TWh



Source: KEGOC

Electricity Balance

In 2009 the electricity generation fell by 2.0% compared to 2008 due to lower demand. There was considerable fall in generation in the Southern Kazakhstan (by 25.2%) mainly due to less loading of "Zhambyl GRES" power plant by 67.9% (down to 1,348 million kWh). However, consumption fell as well so that the electricity generation exceeded consumption by 474 million kWh or 0.6%. As a result the electricity imports from Central Asia dropped – it is dropped by 545 million kWh and this electricity has been mainly imported from Kyrgyzstan.

There was an increased net export of electricity to Russia. In particular, Zone West Kazakhstan decreased importing electricity from Russia due to construction of new 500 kV overhead transmission line "Zhitikara-Ulke" (commissioned in February 2009) that linked Aktobe Oblast with the generating sources in North Kazakhstan. This new OHTL was.
The existing North-South electricity transmission lines are insufficient to meet growing domestic and anticipated export requirements. The present IPS today operates in parallel with the Unified Electricity System (UES) of Russia through a number of 500 kV spur single-line connections between South & North Kazakhstan.

Institutional Structure/Electricity Market Participants

- *Kazakhstan Electricity Grid Operating Company* (KEGOC) JSC is System Operator and owner of substations, switchgear installations, interregional and cross-border transmission lines, as well as substations and transmission lines (220, 500, and 1150 kV) that comprise National Power Grid (NPG) - backbone network of the Unified Power System (UPS) of Kazakhstan National Dispatch Centre of System Operator (KEGOC's branch responsible for the centrally managed dispatch control of the UPS Kazakhstan).

- Regional Electricity Companies (REC) owns and operates the networks on the region level.
- Electricity Transmission Organizations (ETO) that perform the contractual transmission of electricity via own electrical networks to the consumers of the wholesale and retail electricity markets.
- Electricity Supply Organizations (ESO) engaged in electricity buy and sell operations with the electricity generating organizations or centralized auctions with further re-sale to end retail consumers.
- All centrally managed sections of the electricity market of short-term (spot), mid-term (week, month) and long-term (quarter, one year) transactions are executed by the Kazakhstan's Operator of Centrally Managed Electricity Market (KOREM JSC);

In 1999 Kazakhstan electricity market participants established Kazakhstan Reserve Capacity Pool with the main objective to provide capacity reserves on the contractual basis to secure stable supply.

Activities in Kazakhstan for self-sufficiency

In September 2009, Kazakhstan completed its additional North to South 500 kV line, so that improving reliability of power supply to its South, including Almaty, by about 180 MW. The power is supplied from generation units in North Kazakhstan (Ekibastuz GRES). Now the extra power in the North - that used to be exported to Russia - can be supplied to the South, as a result reducing imports from the neighboring Central Asian countries as indicated above. This allows Kazakhstan also to operate independently from UESCA if they decide to do so.

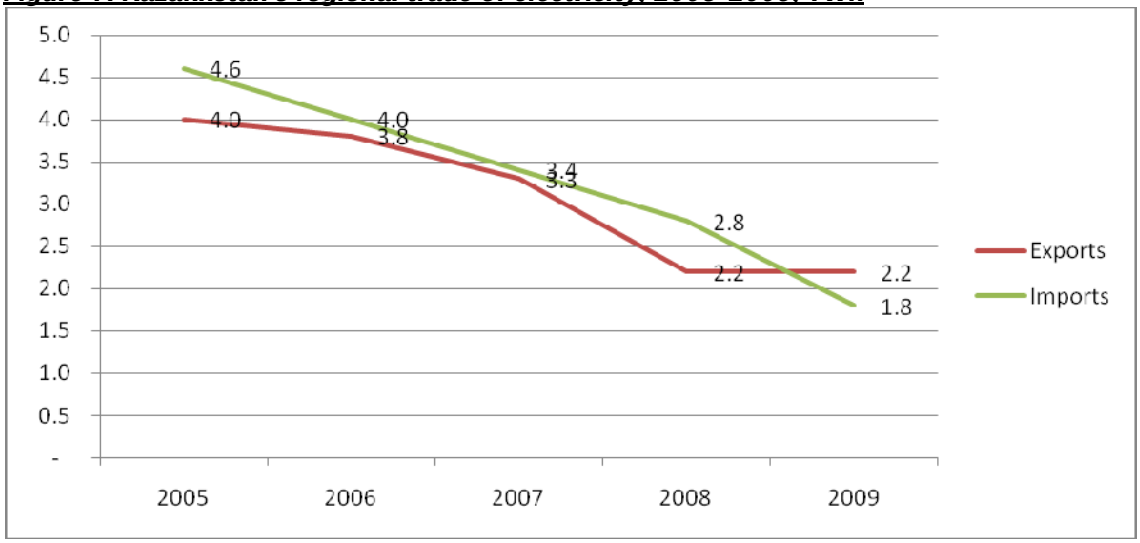
The effect of this can reduce Kyrgyzstan's ability to transfer as normally around UESCA from the lower Naryn Cascade plants to S/S Frunzenskaya and on to Shu and Almaty substations and then back into Bishkek and the rest of north on the two 220 kV lines to substations Glavnaya and Kemin. As a result, the deficit in North Kyrgyzstan would be 720 MW if demand in the north is 1,900 MW as it was in 2007 before the curtailments. In the coming winter of 2010-2011 the supply in the north is going to be limited as it was last year as a result of the curtailments.

Similar to Uzbekistan, Kazakhstan also needs regulation of frequency (power) by the Kyrgyz hydro system. Kazakhstan seems to be more interested in connections through UESCA to Kyrgyzstan for the purposes of frequency regulations as well as possible future exports to more attractive markets in South Asia as described above.

Regional trade decreasing

Kazakhstan's regional trade of electricity has been decreasing in the past years as shown in the chart below. This is due to increased internal transmission capability leading to reduced regional power imports from interconnections. As described above, Kazakhstan started supplying its Southern region from the generation centers in the North using the new 500 kV line. South Kazakhstan had normally covered its winter deficit by imports from neighbouring Central Asian countries.

Figure 7. Kazakhstan's regional trade of electricity, 2005-2009, TWh



Source: KEGOC, consultant evaluation

Strategy for international cooperation

Kazakhstan intends to development cooperation with Central Asian and other CIS countries. In particular, KEGOC's focus lays in deeper integration and formulation of coordinated development strategy for electric power industry and it is currently working "towards creating of efficient and up-to-date electricity market in Central Asia, promoting electricity trade and attracting investments into the power sector" under the support of USAID/REMAP Program that is scheduled to run till 2012.

KEGOC supports and participates in meetings of Coordination Electricity Council of Central Asia (CECCA) and its Coordination Committee. The main issues that have been under recent discussions are performance of Unified Energy System of Central Asia (UESCA), development of future configuration of UESCA and Zone South Kazakhstan, and agreements on frequency (power) control.

Also, KEGOC is interested in establishment of common electricity market with the countries of the Commonwealth of Independent States (CIS), which, in their view, shall be in future integrated with other electricity markets in Eurasia. KEGOC participates in meetings of CIS Electricity Council (last ones held in Baku and Kishinev).

2.5.4 UZBEKISTAN

KEY STATISTICS – 2009	
2008 Electricity Production	50.25 TWh
Installed capacity	12,453 MW
Peak Demand	7,900
Fossil Fuel	86 % (10,643 MW)
Renewable (Hydro)	14 % (1,810 MW)

Source: Uzbekenergo

Current Status of the Power System of Uzbekistan

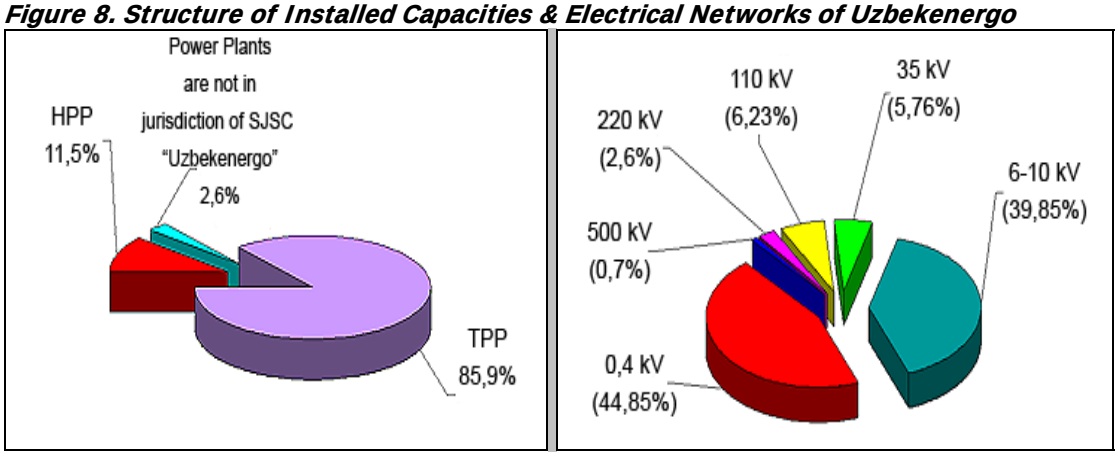
Uzbekistan's Power Industry operates in the framework of "Uzbekenergo" State Joint Stock Company that was established in 2001 in the form of open joint stock company and included

Coal Industry enterprises of the country. Overall, Uzbekenergo includes 53 enterprises and organizations, including 39 Power Plants (open joint-stock companies), 11 unitary enterprises, 2 limited liability companies, company branch-"Energosotish". Uzbekenergo performs centralized electric power supply to the national economy and population, as well as sales of thermal energy in cities of the country.

Uzbekistan's installed capacity comes from the 39 power plants, including (i) 11 large thermal power plants with a total capacity of 10,643 MW (87% of which are on natural gas, and 13% on coal and heavy oil); and (ii) 28 hydro power plants with a total capacity of 1,810 MW.

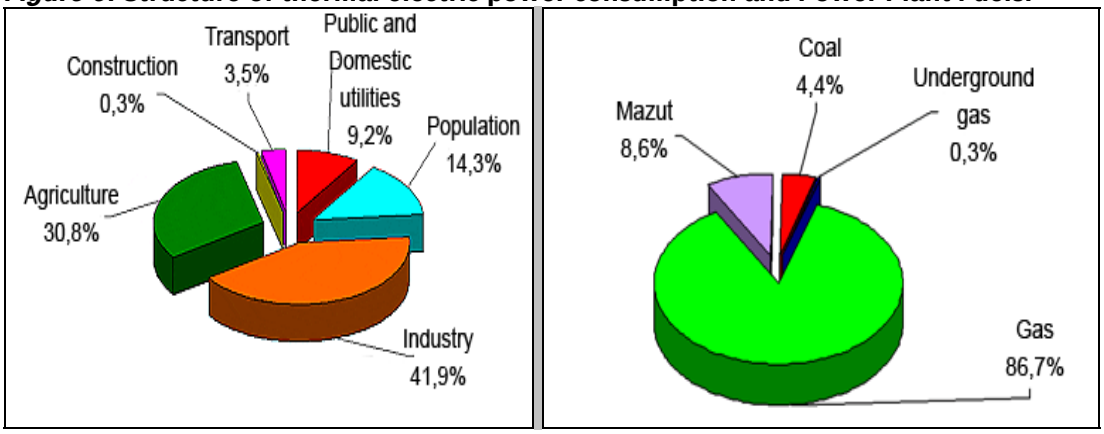
Four large TPPs make up the mainstay of the countries generation – Syrdarya (3,000 MW); Tashkent (1,860 MW); Navoi (1,250 MW); and the new Talimarjan TPP (800 MW). There are no nuclear plants in Uzbekistan though these are under consideration. Uzbekistan generates some 50 TWh of electricity per year and is largely self-sufficient. Average generation of power in the past years is about 50.25 TWh of electricity and about 10 million of Gcal of thermal power. The following diagrams show characteristics of the Uzbek energy system.

Figure 8. Structure of Installed Capacities & Electrical Networks of Uzbekenergo



Source: Uzbekenergo

***Figure 9*. Structure of thermal electric power consumption and Power Plant Fuels.**



Source: Uzbekenergo

Natural gas is the key fuel in the TPP sector as shown in the diagram. In the nearest future gas will remain as the main fuel, although the share of coal is expected to increase up to 10-12% in fuel balance.

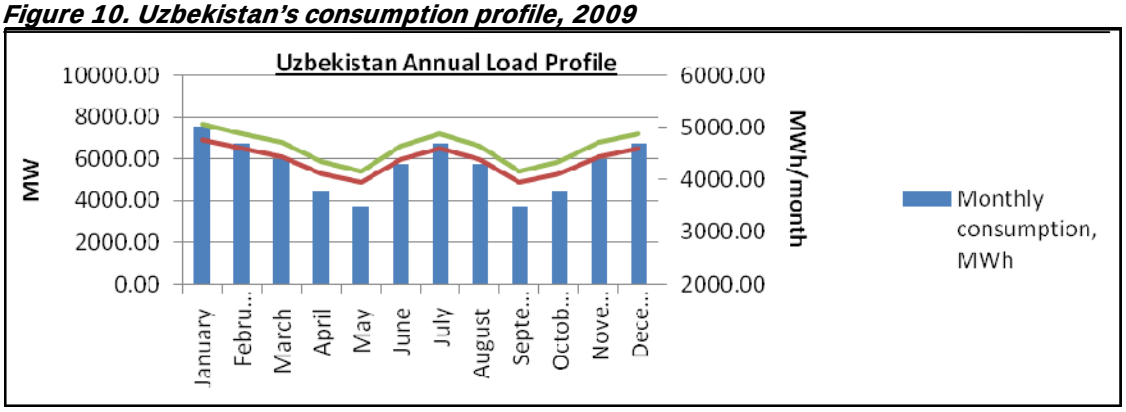
The HPPs makes only about 14% in the total installed capacity. The largest HPPs are located in the upper Chirchik river (Charvak HPP, Khodjikent HPP, Gazalkent HPP) and have the water storage basins allowing to operate in regulation capacity mode.

According to Uzbekenergo this fully meets the demand for power in the country as well as export power supply commitments of the country. Uzbekistan now exports electricity to Afghanistan in the South under the mechanism of a recently-signed PPA.

It is projected by Uzbekenergo that the electricity production in 2010 will grow by 3.3%.

Uzbekistan's current annual consumption profile is shown in the figure below.

Figure 10. Uzbekistan's consumption profile, 2009



Source: Uzbekenergo, consultant estimates

One of the key problems is that, similarly to other Central Asian countries, T&D networks are outdated and inefficient with the exception of some recent projects. Significant renovation and upgrade is needed if the country is to keep up with growing demand (expected to average 4.3 % pa from 2010 – 2014).

Activities in Uzbekistan for self-sufficiency

In July 2009 Uzbekistan commissioned the first unit of the 500 kV substation "Uzbekistan". Then further development of 500/220 kV grids has allowed Uzbekistan to establish its own internal 500 kV system and become self-sufficient from UESCA. If Uzbekistan breaks up the 500 kV Loop of UESCA at substation Lochin, then over two third of Osh oblast and most of Batken oblast of Kyrgyzstan will be left without power supply. Moreover, due to inability to load the lower Naryn Cascade HPPs the Toktogul HPP will have to operate at full capacity all the time to fully load the 500 kV transmission line to North Kyrgyzstan, thus resulting in faster drain of the Toktogul reservoir and also waste water in the lower Naryn cascade. The North will be short of power with inability to get about 280 MW from the lower Naryn around UESCA 500 kV Loop through the Kazakhstan's Shu or Almaty 500 kV substations.
After Uzbekistan officially informed Kyrgyzstan about the Uzbekistan's intent to break up from UESCA in August 2009, there were intense discussions between the two governments. As a result Uzbekenergo confirmed as to continue to operate in parallel. Details of these negotiations are considered highly confidential. It seems that Kyrgyzstan has agreed to

make additional payments to Uzbekistan for staying connected to UESCA at substation Lochin. This agreement was signed till 1 November 2010.
If Uzbekistan decides to switch off from UESCA, Uzbekistan will also be in difficult situation as not being able to effectively regulate its frequency (power) without the Kyrgyz hydro system. In such case the damage to Kyrgyzstan's economy will be more severe than that to Uzbekistan's. Thus, the decision to cooperate or not to cooperate is being made based on political undertakings rather than economic rational. As the agreement will be expired soon, there have been no interactions between the two governments in this regard. Although the meeting of Central Asian Electroenergy Council is scheduled to be held in October 2010 in Issyk-Kul, Kyrgyzstan, experts are not confident that the agreement on parallel operation will be easily extended.

Major projects completed

UzbekEnergo Board indicated that in 2009 investments into modernization of the power sector increased significantly. The completed work during this year amounted to $213 million (including $47 million of foreign loans and $165 million from Fund of Reconstruction and Development of the Republic of Uzbekistan).

The following projects were completed by 2010:

- 703 kilometers of transmission lines (0.4-500 kV);
- 1,569,000 kVA of transformer capacities of 35 kV and higher;
- Reconstruction of infrastructure in countryside with replacement of overloaded 6-10 kV transformers;
- 500 kV "Uzbekistan" S/S with transformer capacity of 1,002,000 kVA;
- 500 kV overhead transmission line (169 km) from Novo-Angren TPP;
- Ash dump AD-2 at Novo-Angren TPP;
- 220kV overhead transmission line (8,4 km) to "Uzgarish" S/S
- 500 kV overhead transmission line «S/S Guzar-S/S Surkhan» (198 km) and AT-2 with the capacity of 501,000 kVA at S/S "Surkhan", that has allowed to increase considerably the reliability of electric power supply to Surkhan-Darya area, and also to increase export deliveries of the electric power in the southern direction.
- 110 kV overhead transmission line «Suvli - Zirabulak» with extension of 57 km to improve the electric power supply to the gas-compressor station "Zirabulak";
- 110 kV S/S with transformer capacity 2x25,000 kVA for external supply to the free economic zone "Navoi".
- 110 kV S/S "Urgut-2" with 100 kV OHTL for the improvement of electric supply to the Urgut industrial area;
- 110 kV OHTL «S/S Gazli – S/S Kurgan» for improvement of supply to the gas enterprises in Bukhara area;
- 2,700 kilometers of 35 – 110kV transmission lines were repaired in the regions of the country. In total 14,3 billion Sum of company's own funds were spent for the realization of the measures directed to the development of the industrial and social infrastructure in the countryside.

CURRENT INVESTMENT POLICY

President of Uzbekistan once earlier pointed out that *"the Republic will be fully independent when it gains the energy independence".* The strategic goals of Power Industry development of Uzbekistan are defined as follows:

- Extension of economic reforms based on development of power market;
- Reliable quality power supply to the economy and population of the country;

- Technical modernization of existing power facilities, improvement of production efficiency;
- Reduction of environmental impact of the power facilities;
- Further development of integration process within the framework of UESCA.

Based on these strategic goals, Uzbekenergo has three priority directions of development of Electric Power Industry:

1. Technical modernization of Power Facilities. This is to provide modernization of out dated equipment of Power Plants, introduction of advanced technologies, reduction of fuel consumption for electric power generation, implementation of measures for maintenance and replacement of process equipment, renovation of turbines, boilers, fuel supply systems and other works at Thermal Power Plants.
2. Reconstruction and further development of electrical network. This is to provide improvement of reliability, flexible power transmission schemes and power loss reductions, development of optimal arrangement of the transmission and distribution networks.

3. Construction of new generating capacities. This includes replacement of worn-out and building new generating capacities in order to meet projected growth of power demand, implementation of modern technologies in power generation, and relief of environmental impact of power facilities.

Major on-going projects

At present, within the established investment framework number of investment projects are underway that are being financed by loans from International Financing Institutions.

- *Tashkent Thermal Power Plant Modernization Project; Construction of 370MW Combined Cycle Power Plant*

A soft loan in the amount of JY 24.955 billion (c. $ 295 million) for the period of 30 years is provided for implementation of this project under agreement between the JBIC (Japan Bank for International Cooperation) and the Uzbek Government. Feasibility Study for «Tashkent TPP Modernization Project» has been completed and approved. The project considers construction of additional capacity - Combined Cycle Power Plant of 370 MW - that is to be commissioned in 2011.

- *Navoi Thermal Power Plant Modernization Project*

Total capacity of Navoi TPP is 1250 MW. The project addresses the construction of additional capacity - Combined Cycle Power Plant of 350 MW.

- *Reconstruction works at OJSC "Navoi Electrical Network"*

The project includes: (1) Reconstruction of 35/10 kV Substation "Langar" in Khatirchinskiy district of Navoi region, and (2) Completion of repair works of 10 kV Suvli branch line outgoing from 35/10 kV Substation "Soikechar" in Nurata district of Navoi region.

- *Construction of HV Line 500 kV from Syr-Darya TPP to Substation «Sogdiana» (222 km)*

The financing has been agreed with Islamic Development Bank (IsDB) for the amount of $ 25 million. Construction works have been started.

- *Construction of HV Line 500 kV from Substation Sogdiana to Talimardjan TPP (200 km) with Outdoor Switchgear 500 kV at TPP*

The project will be financed based on agreement with IsDB and Reconstruction and Development Fund of Uzbekistan effective as of 2010. The project objective is to improve stability of power system, reliability of power supply for the national economy and the population of south-western region of Uzbekistan. The 500 kV transmission line Talimarjan TPP - SS Sogdiana with the length 218 km and 500 kV substation (outdoor switchgear) that will be constructed at Talimarjan TPP. The construction will be carried out by SJSC Uzbekenergo, procurement of equipments and materials are planned within the loan of the International Bank for Reconstruction and Development; subject to the approval of its Board of Executive Directors. The construction period will be from 2010 to 2013.

- *Construction of Gas Turbine Unit at Tashkent TPP*

This Modernization Project is aimed at generating efficiency enhancement, reliability of heat and electric supply to municipal consumers, and meet growing demands for power. The project assumes construction of additional 75 MW of Gas Turbine Units with hot-water boilers and reconstruction of existing boilers PTVM-100 for efficiency improvement. Internal funds and loans from international finance institutions are being considered for project financing.

- *Construction of Tashkent External Power Supply Facilities*

This includes S/s 220kV with feeding HV line 220kV, switching substation 110kV, S/s 110kV, and cable line 110kV. The objective of this investment is to supply electric power to new consumers of the central part of Tashkent and improvement of reliability of existing power supply. Pre-Feasibility Study has been completed and approved by the Cabinet of Ministers.

- *Switching of Boilers of Novo-Angren TPP into all-year-round Coal Burning mode*

The Novo-Angren TPP has capacity of 2100 MW (7 Units 300 MW each). Natural gas used for power generation is to be released due to shift to coal of Angren field located close to the power plant. Pre- feasibility study is underway.

- *New Talimarjan TPP - construction of two 450 MW CCGT units*

The Project will expand power generation capacity by using combined cycle gas turbine (CCGT) technology. Two CCGT units (370-450 MW each) will be constructed at the Talimarjan Thermal Power Plant (TPP

- *Construction of «Kamolot» HPP at Chirchik-Bozsy*

This is to construct a small Hydro Power Plant «Kamolot» with capacity of 8 MW and annual generation of 35 GWh. The Pre-Feasibility Study has completed and is under expertise review at present. The Project financing sources are not identified yet.

Overall, development of renewable power generation is in progress. Priority is given to development of small hydro power under Ministry of Water and Agriculture. This program considers construction of 15 small HPP's with total capacity 420 MW.

Regional Aspect

The Uzbek government has been concerned that upstream countries are not abiding by the water-energy deal that has historically governed water allocations between the two nations. The Uzbek perspective is that they are unable to attain their goals for irrigation needs in summer as well as having to endure unwanted flooding in winter. For example, when Kyrgyz officials released more water for producing electricity during the winter of 2008, most of the Uzbekistan's arable land flooded. When Uzbekistan needed more water in the following summer for irrigation, the reservoir had less water.

On the other hand in Kyrgyzstan, the country's water resources have traditionally been seen as part of the energy sector rather than that of agricultural sector.

The Director of Coordination Dispatch Center shared his views on principles for switching fully to free market economy mechanisms in regional relations. However, those seem to favor interests of Uzbekistan and would need independent judgment. Without mutually beneficial principles that lead to win-win cases there will be no effective solution to the problems and full regional cooperation. There is an inescapable yet finely-balanced interaction between (a) Summer irrigation requirements downstream; (b) Winter power requirements in upper-reach countries, and the ability to import fossil-derived energy in winter to augment these and thus conserve water; and (c) Summer power generation from HPP in both upper and lower reach countries and the ability to export it to avoid revenue-wasting "spill". It requires all the parties to understand and support this balance for the system to operate to the advantage off all.

2. BARRIERS TO REGIONAL COOPERATION

2.1. THREE TYPES OF BARRIERS

Three categories of barriers exist towards agreeing on and implementing a greater penetration of regional power inter-trade.

(i) ***Technical Barriers***

- Lack of reliable infrastructure;
- Lack of robust transmission lines and interconnections;
- Few substations, inadequately maintained; and
- Deficiencies in metering, monitoring and protection systems.

There also exists amongst member states a degree of uncertainty over the adequacy of neighboring countries' fault isolation capability leading to cascade outages inter-regionally. These barriers are the easiest to overcome in that they simply require access to feasibility studies, Technical Assistance and Project Finance.

(ii) ***Commercial Barriers***

- Differing Power Purchase Agreements between neighboring countries, resulting from differing commercial and strategic leverages;
- tariff disparities and sub cost-recovery levels;
- uncertainty over accurate wholesale metering capabilities;
- uncertainties over invoice / debt settlement;
- lack of clarity surrounding barter, offset and contra-settlement balancing of imports and exports.
- Establishing adequate cost-recovery tariff is a key markets objective in Central Asia, as only this will set the scene for adequately-priced PPAs being offered to attract international private investment to the power sector.

Whilst Commercial Barriers require more time and honest debate to resolve than Technical barriers above, they can generally be resolved by committed negotiation, transparency, fairness and understanding of bi-lateral and regional benefits.

(iii) ***Political Willingness***

- Lack of enthusiasm and willingness to participate in mutually-beneficial trading arrangements, at governmental level (not operational);
- political disputes between neighboring countries resulting in communication breakdown and a loss of appetite for participation; and
- internal policies prioritizing self-sufficiency in generation and transmission to the exclusion of adequate consideration of interconnection.

The resolution of these issues requires negotiation, a buy-in to the concept of bi-lateral and regional benefits, and high-level willingness to participate in regional economic improvement. IFI's / MLDB's may well have a role to play here in facilitating this negotiation. It may help that economic benefits be quantified and understood first. The overcoming of this barrier is fundamental to the solution as it is the key catalyst and enabler which must first occur before the barriers at (i) and (ii) above can be effectively addressed.

3. GAPS/OVERLAPS; FUTURE OPPORTUNITIES

3.1. GAPS & OVERLAPS

A number of over and under-concentrations of effort exist and unless identified and rectified these will lead to lost opportunities (arising from gaps in pipeline projects) and cost inefficiencies (arising from duplication of effort via overlaps).

Several International Financing Institutions are examining – sometimes simultaneously – areas within the Demand Side Management sector, such as electric load displacement; energy efficiencies; and building standards (energy). There should be greater coordination of effort here. Many areas require coordinated effort and attention now if they are to avoid becoming critical path issues during future projects and efforts at increased power inter-trade. These include:

1. National Dispatch Centre demand loads are being fed to the Regional Dispatch Centre in Tashkent ("Coordination Dispatch Centre" - CDC) from member countries, but many key loads are not being properly measured or the data is not properly transmitted to the CDC.
2. The CDC receives data acquisition streams from the CAREC countries but presently has little or no supervisory or load / generator dispatch functionality.
3. There are many potential HPPs in the region in the scale-range of 10 – 30 MW which seem feasible but presently lack financing prospects. These should be examined again and prioritized for finance. Many have had feasibility studies carried out but seem for some reason to have fallen out of focus. Both Tajikistan and Kyrgyzstan have more than 1,000 MW of seemingly "ready-to-go" HPP opportunities, in either new-build HPPs or rehabilitation of HPPs. The subsequent study should harmonize all these HPP opportunities into one listing and priorities these according to cost benefit and practical immediacy for the IFI's and others to uptake upon.
4. Several internal 220 and 500 kV transmission backbone and ring-main lines are being constructed in the interests of self-sufficiency with inadequate

attention being paid to their integration into a Regional Power Network in time. These should always be conceived and designed with a view to eventual integration with other regional transmission networks and substations, rather than having to shoe-horn these into a Pan-CAR grid at a later stage.

5. Inappropriate industry structures pose a significant barrier to the development of regional power trade. If the transmission company and some generators are government-owned, it seems unlikely that cheaper power will be imported from abroad while local generators remain idle. Regional energy trade will therefore require the commercial interests of the transmission companies and their managers to be completely separated from those of the generators.
6. In general the operation of the CAR power systems as separate grids results in non-adherence with N-1 international benchmark redundancy provisions (generation & transmission).
7. Inability to mode-optimise results in system losses being much greater than they need be – these losses are shared by all the states.
8. Utility restructuring and unbundling in the interests of greater efficiency of management and operation is to be advocated.

3.2. FUTURE OPPORTUNITIES

A number of Future Opportunities become clear when examining the gaps, overlaps and barriers to future cooperation.

These include:

1. Establishing a priority list of potential HPPs for prioritizing investment.
2. Taking the initiative in overcoming / facilitating political willingness issues.
3. There is a requirement for the development and employment of a Central Asian Load-flow modeling system. This will evaluate predicative load-flow characteristics on the evolving CAR grid, under various dispatch and availability scenarios, and identify system weaknesses which in turn will help identify priority investment areas. The USAID REMAP program is tentatively scheduled to address this gap to follow on from some initial progress made under CARTRANS in 2007.
4. Barter and "in-kind" commercial arrangements which are at times used to settle power interflows should be discontinued, and a transparent commercial monetary arrangement put in place so that indebtedness and accurate quantification of trade can be easily understood and discharged under normal financial control methods.
5. The determinations of the Pillar 3 diagnostics (water – energy interaction) will have a pivotal role to play in understanding and overcoming the barriers described above and thereby removes such illogical wastages such as the need in Tajikistan to spill water in summertime without being able to generate the 3 TWh of potential energy due to export constraints.
6. In addition the Pillar 2 activities and determinations of the ESCC Energy Action Plan (Regulatory Development / Regional dispatch) being undertaken by the World Bank will necessarily be dove-tailed into this study outcome to develop further actions.
7. Transmission constraints (commercial, not technical / operational) restrict the wheeling of energy through Uzbekistan to Turkmenistan). The resolving of this is would produce synergetic benefits to three countries 0 Tajikistan, Uzbekistan, and Turkmenistan.
8. There is renewed pressure to complete the 220 kV line from Tajikistan to Afghanistan and so commence exports.

9. The utilization of Cascade Optimization Software will help maximize operation of multi-power-plant hydro systems, in Tajikistan and Uzbekistan.
10. CAREC ESCC participating countries are advocated to re-confirm their commitment to the development principle and detail to ensure delays and barriers can be more quickly overcome. Information sharing is key to this step (projects information, national supply / demand characteristics etc.)

Regional Energy Trade will certainly, if embraced and progressed, result in increased social, financial, economic and indeed political improvements and benefits to the participating countries by ensuring energy demand is met, and met efficiently, and surpluses traded optimally, whilst taking into account the wide distribution of energy resources and seasonal variations in output. It only remains to develop the regulations, commercial mechanisms, and political willingness to facilitate this trade, and ensure infrastructural improvements are prioritized, financed and implemented.

This development can work and must work. One only has to look to Europe, Scandinavia, and the US; and in particular to island states such as Ireland and New Zealand, to understand how they look enviously towards areas such as Central Asia and aspire towards such physical closeness with their neighbors which facilitates easy interconnection. The whole world is progressing more interconnection to assist meeting energy dispatch and economic targets. Central Asia with its inherent advantage in this regard must take up this challenge too.

APPENDIX 1. ACTIVITY MATRIX - PROJECTS LIST IN MEMBER COUNTRIES

TABLE A. KAZAKHSTAN POWER SECTOR PROJECTS

No.	Project Description	Location	Value '000 $	Funding Agency	Status
1	New TL from Moinak 300 MW HPP	Moinak	48	WB	Underway
2	Development of Wind & Solar	Various		UN	Underway
3	New TL, Moinak to Sary-Ozez	Moinak	*		Planned
4	Chilik River HPP, 254 MW	Alma-Ata	300		Planned
5	Almatin Heps new HPP, 46 MW		60		Planned
6	Atkau Nuclear Power Plant - planning	Atkau	3,000		Planned 2016
7	Semipalatinsk new HPP , 78 MW		95		Planned
8	Kerbulak new HPP, 50 MW		75		Planned
9	Mainak new HPP, 300 MW		310		Planned
10	Chilik Corridor – Wind Power Feasibility				Underway
11	Cascade of small HPPs total 120Mw,	Various	245		Planned 2015
12	New Turgayskaya TPP, Brown coal.		400		
13	New, second, North-South 500 kV TL	North South	326	WB	Completed
14	Protection relays on 12 220 kV SSs &	Various	58		Completed 2009
15	Transmission Rehabilitation Phase II (55 HV SSs)	Various	330	EBRD	Planned 2011
16	Ekibastuz TPP 4000 MW				
17	Ekibastus to China 1500 kV HVDC line with export capacity of 5,500 MW				Planned

NOTE: Kazakhstan has a gross theoretical hydropower potential of 110,000 GWh/year and a technically feasible potential of 60 000 to 65 000 GWh/year. The economically feasible potential is 25 000 to 35 000 GWh/yearThis equates to some 22,000 MW of capacity. So far about 13 per cent of the technically feasible potential has been developed.

TABLE B. KYRGYZSTAN POWER SECTOR PROJECTS

No.	Project Des'000 $cription	Location	Value '000 $	Funding Agency	Status
1	Kambar-Ata 1 HPP, 1,900 MW		2,000		Planned
1	Kambar-Ata 2 HPP, 360 MW		400		Partially complete
2	Dzhanykel HPP, 160 MW		280		Planned
3	Dzhilanaryk HPP, 1 & 2, 160 MW		230		Planned
4	Janykel HPP, 130 MW		160		Planned
5	Karabulun HPP, 163 MW		230		Planned
6	Kokemeren 1 HPP, 360 MW		530		Planned
7	Kokemeren 2 HPP, 912 MW		1,400		Planned
8	Naryn-1 HPP, 62 MW		95		Planned
9	Naryn-2 HPP, 60 MW		95		Planned
10	Datka-Kemin 500 kV TL		330		Planned
11	Datka 220 kV TLs & S/S		230		Planned
12	Sary-Jaz HPP, 1,200 MW		1,900		Planned

13	Kavak TPP (Coal); 1,200 MW	Kara Keche	2,300		Planned
14	Ak-Bulin HPP, 200 MW		290		Planned
15	Aigultash-Samat 110 kV SS and OHTL	Bakten			Planned 2011

TABLE C. TAJIKISTAN POWER SECTOR PROJECTS

No.	Project Description	Location	Value '000 $	Funding Agency	Status
1	220 kV Interconnector to Pul-e-Khumri,	Sangtuda – AFG	58	ADB	80% Complete
2	Rogun HPP; Phase 1, 1,200 MW	Vakhsh River	900	TBD	Planned - 2014
3	Rogun HPP; Phase 1, 2,400 MW	Vakhsh River	3000	TBD	Planned
4	Sangtuda 1 HPP, 670 MW	Vakhsh River		Iran	Russia - UES
5	Sangtuda 2 HPP, 220 MW	Vakhsh River	360	Iran	2010
6	Dashtijum HPP	Dashitum	6,500		Planned
7	North – South 500 kV TL	Central	280	China	Complete 2009
8	Kairakkum HPPs Rehabilitation +	Kairakkum	55	WB *	Planned
9	Varzob HPP Rehabilitation, 90 MW	Varzob	24		*
10	Nurek HPP Switchyard Rehabilitation	Vakhsh River	55	ADB/KfW	Completed
11	Golovnaya HPP Rehabilitation, + 30	Vakhsh River	28		*
12	Performance Optimisation – Elect.	Dushanbe	10	ADB	Planned - 2011
13	Scada / National Dispatch Centre	Dushanbe	14	ADB	Planned - 2013
14	Rehabilitation of 6 x 220 kV	Countrywide	39	ADB	Planned 2013
15	Geran – Rumi 220 kV new TL	Khatlon	18	ADB	Planned 2013
16	Kairakkum – Asht new 220 kV TL	Sugd	16	ADB	Planned 2013
17	Optimisation of Vakhsh HPPs Cascade	Vakhsh	3	ADB	Planned 2012
18	Zarafshon HPP x 4	Zarafshon		*	
19	Shurob HPP, 750 MW	Vakssh	1,200	*	
20	Nurobad-2 (Sinohydro) 180 MW HPP	Vakhsh	300	PRC	Planned
21	DSM / Loss Reduction Programme	All		W.B.	
22	Energy Loss Reduction Project	All	17	IDA/Swiss	
25	Pamir Energy Co.Development.		*	AK, IDA,	
26	Pyandzh HPP, 1000 MW	Vakhsh	1,800	*	Planned
27	Pamir-=2 HPP, 14 MW	GABO	18	*	Underway
28	Kaphtarguzar HPP, 650 MW	Obkhingou	1,000	*	Planned
29	Reconstruction of Dushanbe Distrib.	Dushanbe	16	Kuwait	
30	220 kV Hatlon-Lolazor new TL.		58	China	*

*Requires ratification

NOTE: The gross theoretical hydro potential is 527 000 GWh/year, representing about 60 200 MW of capacity. About half of this is economically feasible. The technically feasible hydro potential of the main river basins is given as being some 30,000 MW of capacity (or 25,000 MW of additional capacity, which equates to €1.5 bn at 2 c/kWh)

TABLE D. UZBEKISTAN POWER SECTOR PROJECTS					
No.	**Project Description**	**Location**	**Value '000 $**	**Funding Agency**	**Status**
1	Uzbekistanskaya 500 kV Substation +	Novo-Angren	171		
2	Tashkent CHP Modernisation– 370 MW	Tashkent	142	JBIC Japan	Underway (2011)
3	Navoi TPP – Additional 346 MW CCGT	Navoi	350		FeasibilityComplet
4	Tashkent CCPP, 370 MW	Tashkent	463	Various	Planned
5	Novo-Angren TPP – Switch from gas to		227		Planned
6	Talimarjan TPP expansion - + 900 MW		1500		Planned
7	Kamolot HPP, 8 MW	Chirchik-	12		Feasibility
8	New 500 kV TL SyrDarya TPP to Sogdiana	Sogdiana	113	IsDB	Underway
9	New 500 kV TL Talimarjan TPP to Sogdiana	Sogdiana	93	IsDB/IBRD	Planned (2013)
10	Tashkent 220 kV SS + 220 kV TL	Tashkent			Pre-Feas
11	New 500 kV OHTL Guzar-Syrkhan	Guzar	129		
12	Asia Solar Energy Development – 3,000	REGIONAL	2,250	ADB	Planned
13	Andijan HPP, 17 MW (China Eximbank)	Andijan	28	China	Complete
14	Ahangaran HPP, 50 MW (China Eximbank)	Ahangaran	70	China	Complete
15	9 x Small HPPs, to total 324 MW	Various	500	Uzbekener	Planned
16	2 x HPPs, Tashkent & Surkhandar, 204 MW	Various	320	Uzbekener	Planned
17	Tyuyamuyunskaya HPP, 156 MW		230		Completed
18	Pskem, Expansion 459 MW		*		Planned
19	Shakhrikhan-0, 30 MW		50	*	Planned
20	Uycha 1 & 2, HPPs, 59 MW				Planned
21	Akkavak 1 & 2 HPPs, 44 MW				Complete
22	Tupolong HPP, 90 MW		115	China	Planned
25	Rehabilitate 500 kV TL Syrdarya-Tashkent	Syrdarya TPP	14		Planned
26	SCADA – 1st stage	Various	35		Planned
27	New SS's 220 kV at Ishtykhan /		34		Planned
28	New 500 kV TL, Syrdarya to Novo-Angren	Novo-Angren	53		Planned
29	New 422 Turbine unit at Angren TPP	Angren	150		Planned
30	New HPP Nizenchatkal, 100 MW	Nizenchatkal	105		Planned
31	New HPP at Akbulak, Tashkent, 60 MW		62		Planned
32	Modernisation of HPPs 6,7,8,10 +45 MW	Urta-Chirchik	45		Planned
33	Syrdarya TPP SDPS Expansion 600 MW		600	USTDA	Completed

NOTE: The gross theoretical hydropower potential of uzbekistan is 88 000 GWh/year. The technically feasible potential is 27 400 GWh/year. In 1993, the economically feasible potential was estimated to be 15 000 GWh/year. So far about 20 per cent of the technically feasible hydropower potential has been developed.

APPENDIX 2. LIST OF PERSONS MET BY THE CONSULTANTS

Name	Position / Organization
Kazakhstan	
Askan Smailov	Head of Energy and Coal Industry Division Ministry of Industry and New Technologies
Magripa Tussupbayeva	Chief Expert, Power Industry Development Division Ministry of Industry and New Technologies
Eldar Duysetayev,	Head, Tariff and Technical Regulation Division Agency on Regulation of Natural Monopolies
Tolebay Adilov	Director, Kyoto Protocol Department Ministry of Environmental Protection
Sergey Katyshev	Adviser to the President KEGOC
Marat Auyelbek	Senior Manager, Electricity Market Development and Analysis Division, National Power Grid (NPG) Development Department KEGOC
Kanysh Moldabayev	Head, NPG Development Department KEGOC
Yuriy Marulin	Senior Manager, Project Administration Division Project Management Department KEGOC
Serik Zheksenbinov	Planning and Economic Development Department KEGOC
Farida Zharmagambetova	Senor Manager, NPG Development Department KEGOC
Eraly Shinasilov	Senior Dispatcher, National Dispatch Center
Sergey Katyshev	Adviser to the President KEGOC
Kenzhehan Abuov	Regional Cooperation Coordinator (RCC), ADB
Christopher Hnanguie	Country Economist, ADB
Aliya Mukay	Operations Officer, Infrastructure and Sustainable Development, World Bank
Stanislav Kim	Head, Energy and Environment Unit, UNDP
Sergey Yelkin	Energy Projects Coordinator, USAID
Michael Trainor	USAID
Douglas Herron	Head of the Representative Office, AES Company
Revaz Tvalchrelidze	Treasury Leader, AES Company
Olga Kokoshkina	AES Company
Kyrgyzstan	
Osmonbek Artykbaev	Minister of Energy
Avtandil Kalmambetov	Deputy Minister of Energy
Ilia Anikeev	Director, State Department on Fuel and Energy Complex Regulation
Mirgul Aidarova	Deputy Director, State Department on Fuel and Energy Complex Regulation
Addylda Israilov	Deputy Director General, JSC Electric Power Plants
Raimbek Mamyrov	Director General, National Electrical Grid Company
Alexander Borodin	Technical Director, National Electrical Grid Company

Patrick Bernstein Galiona Leonova	Director Central Asia, Ineo Energie, Gas de France Suez Chief Engineer, Ineo Energie
Bobir Alimov	ADB
Aidana Aidarbekova	RCC, ADB
Mirlan Eshenaliev	Project Coordinator, Energy Sector, ADB
Tajikistan	
Akram Suleymanov	Deputy Minister and CAREC Energy Focal Point Ministry of Energy and Industry
Rashid Gullov	Deputy Chief Engineer, Open Stock Holding Company Barki Tojik
Suhrob Rahomov	Deputy Chairman, Open Stock Holding Company Barki Tojik
Usmonali Usmonov	Executive Director, Management Unit for Electro-Energy Sector Government of the Republic of Tajikistan
Shuhrot Najmetdinov	Team Leader of Group of Local Consultants
Masayo Murakami	Project Formulation Advisor, JICA
Galymzhan Oinarov	Senior Manager, Eurasian Development Bank
Tony Bull	Manager Transmission and Distribution, SMEC
Makoto Ojiro	Country Director, ADB
Faruh Kasymov	KfW Development Bank
Michael Jones	Resident Coordinator, UN
Boris Fillipov	Attache, EU
Rustam Aminjanov	Senior Adviser for Tajikistan, CAREC
Abdurashid Kurbonov	Water Team Manager, USAID
Azam Sadykov	AREVA Transmission and Distribution
Henry Zipper de Fabiani	Ambassador of France
Zarrina Abdulalieva	Project Implementation Officer, TJRM
Mutabor Rahimova	Administrative Assistant, TJRM
Uzbekistan	
Bahodir Abdurahmanov	First Deputy Chairman, Uzbekenergo State Joint Stock Company
Eso Sadullaev	Head, National Dispatch Center, Uzbekenergo
Khamidulla Shamsiev	Director, Coordinating Dispatch Center "Energy", United Power System of Central Asia
Abdihamid Juraev	Head, Economic and Forecasting Department, Uzbekenergo
Umar Karimov	Chief Dispatcher, Coordinating Dispatch Center "Energy"
Dmitriy Kulbatsky	Chairman of the Board, SredAzEnergoSetProject
Vadim Maluga	Chief Engineer, SredAzEnergoSetProject
Alexandr Loktionov	Deputy Director, BVO "Syr-Darya"
Tanat Saliev	CAREC coordinator in Tashkent

APPENDIX 3. RECENT DEVELOPMENT OF UESCA