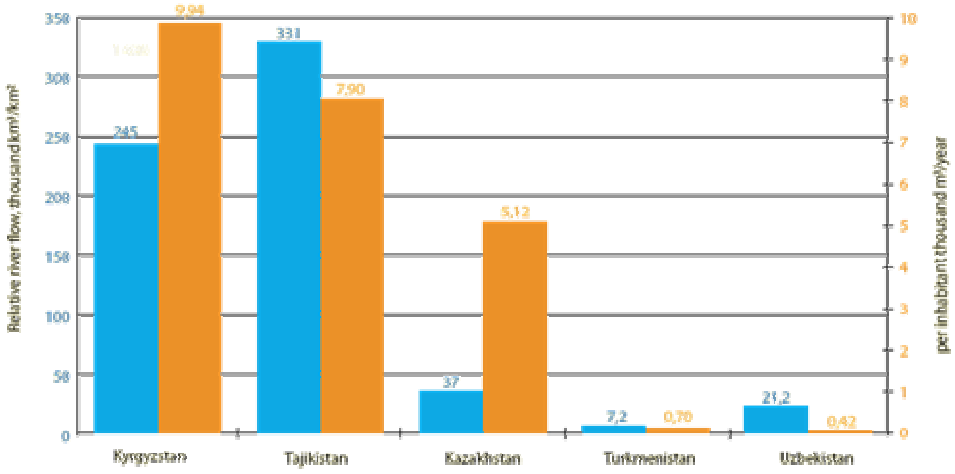
WATER AND ENERGY

CHALLENGES AND TRENDS IN ENERGY IN THE CENTRAL ASIAN REPUBLICS[1]

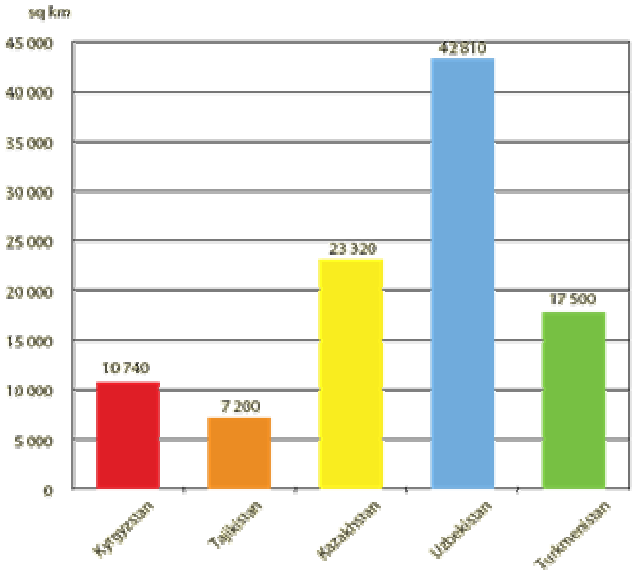
1. Water: a precious common good

Most of Central Asia's water resources are stored in more than four thousand glaciers covering an area larger than 4,000 km². Waters from their melting account for up to twenty-five percent of the total river flow and feed the Syrdarya, Amudaria, Chui, Talas, and Tarim Rivers, the largest rivers in the region. There are more than ten large water reservoirs with a total capacity of thirty billion cubic meters and dozens of smaller reservoirs used mainly for irrigation purposes.



Regional distribution of relative river flow (in thousand cubic kilometer per square kilometer) and river flow per inhabitant (in thousand cubic meter per year)

While Tajikistan and Kyrgyzstan are the 'water towers' of the region, Uzbekistan and Kazakhstan are the biggest consumers of water. The river flow of Kyrgyzstan and Tajikistan is more than three times that of Turkmenistan and Uzbekistan combined. Compared with Kyrgyzstan and Tajikistan, Uzbekistan, Kazakhstan and Turkmenistan benefit more from water resources as their irrigated area of more than 75,000 km² considerably exceeds the irrigated area in Kyrgyzstan and Tajikistan. Despite this, Kyrgyzstan and Tajikistan bear the main burden for the maintenance of reservoirs and water transportation facilities supplying water to the lowland areas throughout the whole region.



Area of irrigated land in Central Asia in square kilometers 1998 (Turkmenistan 2003; source:)

[1] Based on the materials of CAMP Alatoo Synthesis Brochure 2008

Stored water can be used for energy purposes

Issues regarding payment and the seasonal distribution of water give rise to disputes between the countries concerned. As in most parts of the world, water is considered a common good to be distributed among all states free of charge, while gas and oil resources are considered the property of the respective state. Turkmenistan, Uzbekistan and Kazakhstan thus sell energy resources to Kyrgyzstan and Tajikistan while the latter two provide water free of charge.

The regional average annual water consumption is 4.8 thousand cubic meters per person per year. This corresponds to twice the amount of Western countries. The main reasons are poor infrastructure with high rates of loss and the inappropriate use of water. Overall, the total supply of water is insufficient with 62 - 90% and 70 - 76% of the needs satisfied in urban and rural areas respectively.

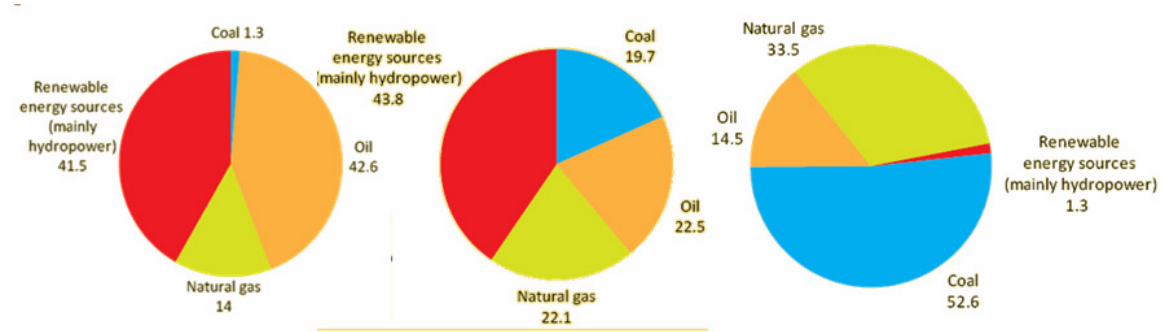
2. Energy Sources

Central Asia has large stocks of energy but it is unevenly distributed among the different countries of the region. The data on the explored reserves of energy resources in Central Asia is shown below:

Type of power resources	Coal, billion tons	Oil, million tons	Gas, billion $м^3$	Uranium, thous. tons	Water power, billion kW/hr/pa
Kazakhstan	34,1	4800	2000	601	27
Kyrgyzstan	1,34	11,5	6,54	*	52
Tajikistan	0,67	5,4	16,8	*	527
Turkmenistan	*	85	2900	*	2
Uzbekistan	1,95	82	1850	83,7	15
CAR	38,06	5183,9	6773,34	684,7	623

While Kazakhstan is extremely rich in oil and natural gas, the main hydropower resources are located in Tajikistan and Kyrgyzstan. The bulk of Kazakhstan's electricity production (52,900 GWh in 1998) is predominantly from fuel-burning power stations.

Approximately 7% of the electricity generated in Kazakhstan is produced by hydroelectric plants. Kyrgyzstan and Tajikistan combined produce only 31,400 GWh of electricity of which 89.6% is hydro-energy from the Nurek (Vaksh River, potential productivity 3,000 mega Watts) and Toktogul (Naryn River, potential productivity 1,200 mega Watts) power stations while only 5.4% is provided by the fuel-burning power stations located in Bishkek, Osh and Dushanbe.



Composition of primary energy supply for Tajikistan, Kirgistan ϕme Kazakhstan according to energy sources (Human Development Report 2007/2008 In: www.laender-analysen.de/zentralasien 2008)

Since 1992 power production has decreased in the region due to the deterioration of power production facilities and distribution infrastructure. Industrial power consumption has also decreased due to the closing of many factories. While aging power supply lines often break down, local people who steal wire in order to sell it as scrap metal sometimes cause malfunctions.

Wood chopping negatively affects the sparse tree cover but is a common phenomenon in Central Asia

Due to increasing demand, consumption, and ongoing problems relating to the distribution of energy, many areas of Central Asia are experiencing and will continue to experience energy deficits and resulting higher energy costs. In the mountainous areas of the Central Asian states, mainly in Kyrgyzstan and Tajikistan, inadequate and deteriorating energy infrastructures have resulted in an increased demand for local fuels such as dung and wood, which are affordable but as yet unsustainable alternatives to coal and electricity. This scenario will ultimately negatively affect livelihoods since using dung for fuel and not fertilizer will cause soil fertility degradation and reduce agricultural productivity. Ultimately, the shortage of energy resources in many rural areas is the key limiting factor for their further development and the sustainability of future generations.

Central Asia is rich in renewable energy sources (RES) such as solar, wind, hydropower, and biofuels. The development of renewable energies will contribute to solving many of the critical problems presently facing rural areas, for example:

- Reliability improvement of power supply and organic fuel saving;
- Solution of problems of local power and water supply;
- Improvement of living standards and employment status of local population;
- Ensuring of sustainable development of remote areas in mountainous zones;
- Fulfillment of the countries' commitments relating to implementation of agreements on nature conservation.

Uzbekistan has considerable renewable energy resources (RES) totaling 51 billion tons of oil equivalent. With modern technology the potential level is of output is 179 million. This is more than 3 times the current annual power production output. Currently, hydropower accounts for a significant share in renewable energies in the power balance of Uzbekistan. The hydropower micro generation development program provides for construction of 15 small HPP with the total installed capacity 420 MW and average annual power generation 1.3 billion kWh.

In Kyrgyzstan, there are plans to use RES in resort zones and reserves, and also in places where traditional power construction will lead to degradation of farmlands, pastures and forests. For example, implementation of the Resolution of the Government of the Kyrgyz Republic on March 20, 2006 entitled “On phased transfer of cultural and recreational establishments of the Issyk-Kul oblast to solar energy” is currently underway.

In Kazakhstan, a project is under consideration relating to use of renewable resources of mountain rivers and wind corridors in the East Kazakhstan and Almaty oblasts. A complex of wind and HPP with total capacity up to 10,000 thousand MW could generate a minimum of 35 billion KWh a year. Based on studies to date, there exist approximately 453 potential power sites with a total capacity 1380 MW. There is an annual yield of animal and poultry waste products totaling 22,1 million tons dry weight, which is equivalent to 8,6 billion m^3 of gas. Annual volume of plant waste products is 17,7 million tons, which is equivalent to 14-15 million tons of fuel oil equivalent, or 12,4 million tons of residual oil.

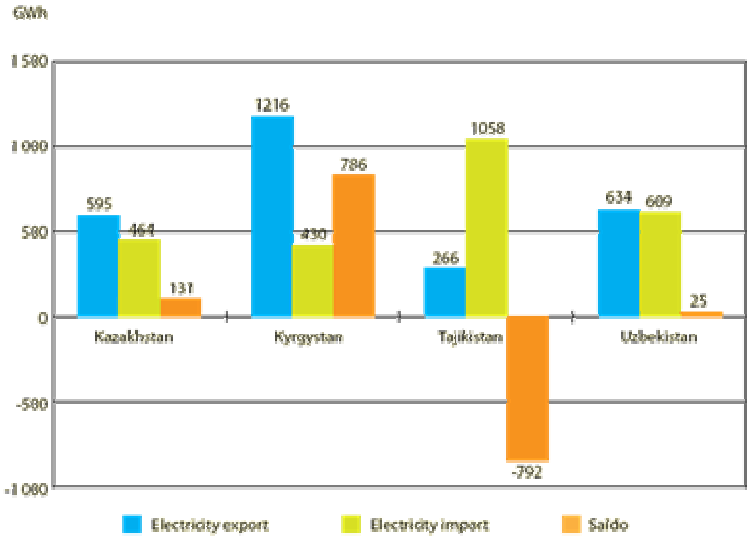
The government of Tajikistan has placed among its priorities the energy needs of the population living in remote areas, far away from the centralized power supply systems, and they plan to solve the problem by installing power facilities on the basis of non-traditional renewable energy sources. The Government has developed and approved the Target Comprehensive Renewable Energy Use Program in Tajikistan for 2007-2015.

With assistance of the Supreme Science and Technology Council under the President of Turkmenistan, the Renewable Energies Development Strategy has been developed which provides for wide use of solar and wind power facilities. Experts of the “Gyun” NGO have developed projects of the so-called “solar villages” in which all life-support systems and waste utilization are carried out with the help of solar power systems.

Application of renewable energy sources allows solving many economic, social and ecological problems in the region. Decreases in production of raw hydrocarbons, import restrictions and energy carrier price inflation create favorable conditions for development of non-traditional renewable energy sources (RES) and small hydroelectric power plants (HPP).

3. Water for food or water for electricity?

Before 1991 the Toktogul hydropower station took farmers’ irrigation needs into account; from October until March a minimum of electric power was produced to save water for summer irrigation. With independence Kyrgyzstan and Tajikistan – now forced to be self-sufficient regarding energy procurement – began to use more water to produce electricity with their hydroelectric power stations. The new strategy demanded the accumulation of water during summer and the release of more water during winter when demand is at its peak. This shift caused water shortages for downstream users and finally led to tensions and conflicts, since agriculture ultimately exploits more than 90% of available water. Due to inappropriate water use and poorly coordinated water management, the rivers Amudaria, Syrdaria, Ili, Tarim, Nary and others dry out before reaching the large lowland basins, in particular the Aral Sea which is now a victim of desertification. This problem is further aggravated by poor quality irrigation channels and distribution facilities, causing water losses of around 20% during transportation.



Trading of electrical energy in Central Asia in giga Watt hours for 2002
(Worldbank In: In: www.laender-analysen.de/zentralasien 2008)

Moreover, the traditional flooding irrigation method used in most rural areas consumes a lot of water: fourteen to sixteen thousand cubic meters of water per hectare. Alternative methods that could reduce this high water consumption by up to 25% are still out of reach due to their high expense.

The dispute over irrigation water has a long history. Currently the Isfara-Batken region is considered one of the most explosive parts of the Ferghana valley. Both a steadily increasing water shortage and a growing deficit of agricultural land may lead to a renewal of ethnic conflicts. This phenomenon has occurred at previous times, too. Recent conflicts occurred in 1969, 1974 and 1989. All together, they led to several thousand casualties.

Additionally, in order to improve their poor economic situation, Kyrgyzstan and Tajikistan are now forced to sell electricity to their neighbors. This imposes limits on domestic consumption and restrictive measures that burden the local population. Currently Kyrgyzstan supplies about 30% of the electricity it produces to Uzbekistan and Kazakhstan while Tajikistan exports 26% of its production. Remote mountain villages suffer the most by receiving electricity only sporadically.

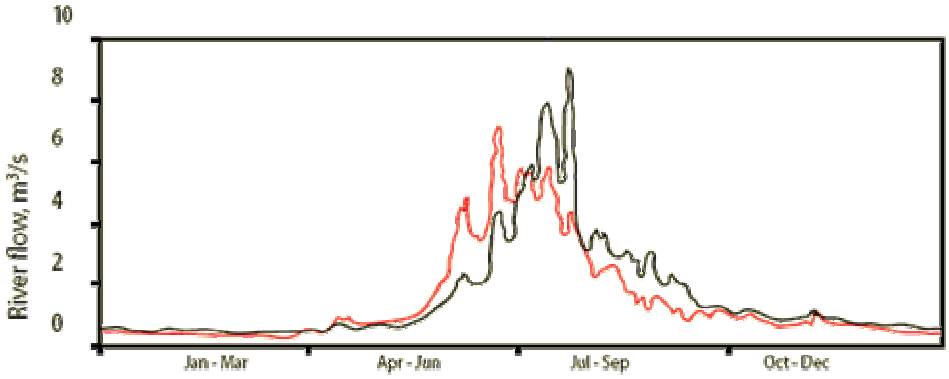
Taking the negative effects of climate change into account, the general Central Asian water deficit will most probably continue to increase in the future. This will be further aggravated by population growth, the increasing water use per person that comes with changes in lifestyle, and water withdrawals by Afghanistan from the Vaksh River in Tajikistan.

4. Climate change Issues

Central Asia comprises of many arid and semiarid climatic zones. This makes the entire region particularly sensitive to environmental changes, in particular climate change. According to the latest report of the 'Intergovernmental Panel on Climate Change' (IPCC) concerning Asia published in 2007, climatic change is likely to have considerable negative impacts in the region. Experts foresee a pronounced warming of about 3°C until 2050, with dramatic consequences on water availability. The major expected impacts are increased desertification, decreased water resources, and an increase in natural hazards. It is further predicted that the degradation of natural resources will reduce living standards and contribute to increase poverty, diseases and migration.

Many hills and mountains appear completely

The increase in temperature in Central Asia is leading to intensive glacier melting and consequently a temporary increase of water flow in some rivers. Over the last twenty years, more than one thousand glaciers have disappeared in the Pamir-Alai. Glaciologists forecast that snow and glaciers will continue to melt rapidly. The southern slopes will be the most affected with about 74% reduction of their glacier coverage, while northern slopes will lose about 32%. A recent study in the watershed of the Central Tien Shan massif has shown that over the last 40 years glacier surface has decreased by 28%, most of which took place in the last two decades.



River flow of the Sokuluk river in 2003 (black line) and under scenario 2 of climate change with an assumed increase of temperature by 2°C and a glacier reduction of 13.7% (red line) (Ershova et al. 2008)

The modeling of river flow in the same watershed (Sokuluk) forecasts the maximum (peak) water flow shifting from July to June. The IPCC report 2007 predicts a decline in summer precipitation for Central Asia leading to the expansion of deserts and semi-deserts as well as periodic severe water stress conditions putting agriculture in a very sensitive situation. Severe droughts, floods, landslides, soil degradation and even storms are expected, which will affect the overall population and the respective economies. Currently degraded vegetation cover affects 77% of the land resources, about 9% is affected by salinisation of soils due to inappropriate irrigation practices and about 6% suffer from water erosion.