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Naryn - Syrdarya cascade of reservoirs - the basis of regional stability

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ABSTRACT: This article shows the problems that arise in the distribution of transboundary water resources in the Syrdarya basin to Central Asian countries, and ways to solve them.

KEY WORDS: River, pool, reservoir, hydroelectric power station, cascade, irrigated, energy, water consumer, waterworks, regime, water management.

I.INTRODUCTION

The Syrdarya is formed at the confluence of the Naryn and Karadarya rivers in the eastern part of the Fergana region with length of 2337 km.
The total surface water resources of the Syrdarya are 40.84 km3, of which 37.88 are from the sources to the Chardara reservoir.
The runoff of the Naryn, Karadarya, Chirchik, and Syrdarya rivers in the area from the Toktogul reservoir to the Chardara reservoir (with a total length of about 1000 km) is regulated by the Naryn-Syrdarya cascade of reservoirs (Fig.

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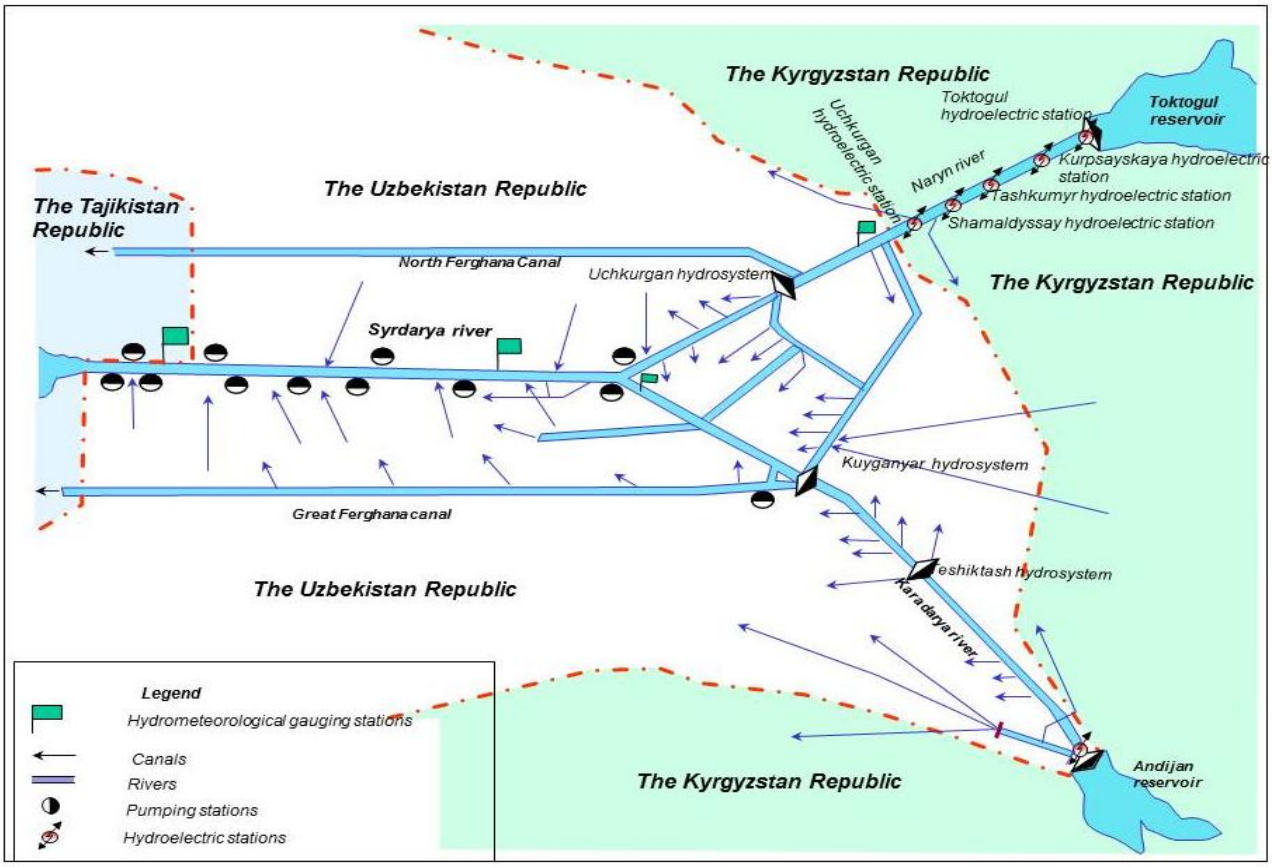

There are five major reservoirs of the cascade: the three upper reservoirs of long-term regulation - Toktogul (design full capacity 19.5 km3), Charvak (2.0 km3), Andijan (1.9 km3), and two channel-type seasonal reservoirs - Kairakkum (4, 03 km3) and Chardara (5.7 km3). The total actual useful capacity of the cascade reservoirs is currently 24.1 km3. In addition, in the Syrdarya river basin there are 9 major hydroelectric power stations. The water sector of the Syrdarya river basin, a complex set of hydraulic structures that has been created over many decades, the operation of which has allowed to achieve an extremely high degree of regulation of river flow (0.93) and to provide living conditions for about two tens of millions of people living in the basin.

The irrigated area in the Syrdarya river basin is about 3.2 million hectares, including 1775.7 thousand hectares irrigated from the Naryn - Syrdarya river. Kyrgyzstan accounts for 59.9 thousand hectares, Tajikistan - 185.3 thousand hectares, Kazakhstan - 491 thousand hectares and Uzbekistan - 1039.5 thousand hectares.

Among the most important water consumers of the basin, water resources are distributed as follows: about 92% is used for irrigation, from 3.5 to 4% - household and municipal water supply, 2% - industrial technical water supply, 1.5% agricultural water supply, the rest is distributed among other water consumers, including fisheries. At the same time, water resources are used in energy.

II. METHODOLOGY

The distribution of water resources is carried out with the help of large waterworks, head water intake facilities and inter-republican channels.

The largest reservoir of the cascade - Toktogul - was commissioned in 1974 and is intended for many years of regulation of river flow. The design regime of the reservoir is irrigation and energy. The project provided for three quarters of the annual volume of releases from the reservoir to be carried out during the growing season, compensating for the non-generated electricity during the winter accumulation of water in Toktogul by the organization, within the framework of the former USSR, the supply of heat and energy resources from Russia, Kazakhstan and Uzbekistan to load thermal power plants in Kyrgyzstan, as well as the flow of electricity through the power system in Central Asia.

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From the moment the reservoir was put into operation until 1991, the following items were delivered to Kyrgyzstan on average each year on average as compensation:

- gas 1740 million m3
- fuel oil 400 thousand tons
- coal 1365 thousand tons
- electricity 5140 million kWh

In the summer, with maximum releases from the reservoir due to the generation of the Toktogul hydroelectric power station, partial compensation of the electric power occurred through its reverse flow through the aforementioned power system. The regulation of river flow into the growing season was carried out according to an irrigation schedule, and in the remaining months only energy releases in the amount of 80 m3 / s and sanitary releases in 100 m3 / s, i.e. only 180 m3 / s, came from the reservoir.

In 1991, due to the collapse of the Soviet Union, the initial situation in the region completely changed. Due to the economic downturn, disruption of economic interstate relations and not always successful attempts by the states of the region to enter the world market system, the ability to compensate for unearned energy was reduced, and in the absence of other alternatives, the Kyrgyz Republic was forced to provide for its needs at the expense of the Taktogul hydroelectric station, which prompted the transfer reservoir for energy operation.

Such a change in the regime of the Toktogul reservoir in recent years has caused a shortage of water for irrigation, a decrease in water supply to the Aral Sea, since the main flow went along the river in winter, when water flow through the river decreases due to the difficult ice situation in the lower Syrdarya and insufficient capacity river bed in the area of Kzyl-Orda city, as a result of significant volumes were dumped into the Arnasay depression (from 1993 to 2010 more than 27 km3 were dumped) and were uselessly lost, flooding the adjacent territories and causing damage.

It should also be pointed out that the environmental situation in the basin has worsened, since in winter the riverbed is filled and return water discharge has been reduced, which previously improved the riverbed area, and in summer the reduction in river expenses is so significant (sometimes it stops altogether) that the sanitary-epidemiological situation worsens as a result in the middle and lower reaches of the Syrdarya.

In this regard, the Toktogul irrigation (design) mode of operation is particularly effective, since it coincides with the natural hydrological regime of the river. Meanwhile, it can be seen from the foregoing that the mode of operation of the reservoir that has developed in recent years is completely deformed, like the regime of the river. With an average long-term natural flow of the river in the range in the autumn-winter period of 2.5 km3, in fact, it reaches a value of up to 8.0 - 9.0 km3 or more than 3 times the natural indicator. The summer regime has changed in a similar way: the average long-term summer runoff is 9.0–11.0 km3, and releases at the site of the hydroelectric power station are 4.5–6.5 km3 or 1.4–2.4 times less than the natural value.

Economic studies of SIC ICWC show that when transferring the main hydropower plants of the cascade to the energy regime, it is possible to produce 12 billion kWh, while maintaining the previous regime, this value will be 8 billion kWh. But such a gain deprives the downstream countries of about 6 billion m3 of water, that is, reduces the water availability of their lands by 35%, irrigated agriculture in all the republics will be directly damaged by about 360 million US dollars and the total - about 310 million dollars, then there is only about 670 million dollars.

If we take the irrigation regime as a basis, the energy sector will receive less than $ 20 million worth of production and $ 100-160 million of gross income at world prices at cost.

In recent years, in order to overcome the contradictions that have arisen, interstate agreements have been concluded (since 1995), which established the amount of compensatory heat and energy supplies from Uzbekistan and Kazakhstan to the Kyrgyz Republic and fixed the size of vegetative releases from Toktogul (6.5 km3), which allowed years of average annual water availability with difficulty to meet the needs of irrigated agriculture in the region; winter releases were in the range of 7.0 - 8.2 km3 (Fig. 2). The practice of cooperation between Central Asian states that has been established in recent years, in which the Republic of Kazakhstan and Uzbekistan compensate the Kyrgyz Republic for the spent water resources of the main reservoir of the Naryn cascade by supplying heat and energy resources, makes it possible to meet the needs of irrigated agriculture in the region only during vegetation, but does not affect the regime of the Toktogul hydroelectric complex in the autumn-winter period, which “Kyrgyzenergoholding” builds based on the needs of covering daily schedules electric loads of Kyrgyzstan.

Meanwhile, there is no doubt that it is impossible to interrupt Toktogul’s work in this way, especially in low water, and the established regime in the end ultimately threatens enormous damage to the energy industry itself.

The compensatory supply mechanism for non-generated electricity is still the most optimal and most important way to reconcile and smooth out the antagonistic contradictions between the two water users of the Syrdarya River - hydropower and irrigation. But all that has been undertaken so far to establish compensatory supplies and improve the working hours of the Toktogul reservoir are essentially cosmetic measures; fundamental solutions are needed to break

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the deadlock. These proposals should take into account the independence of the states of the Syrdarya basin, their attempts to enter the world community and introduce market relations in their own country, opportunities that have now emerged to go beyond the region and, most importantly, that the economy can only assists break the deadlock if it is discarded outdated political beliefs and misconceptions, prejudices and a habit of administration.

III.CONCLUSION AND FUTURE WORK

An analysis of the use of heat, energy and water resources in recent years allows us to formulate proposals for creating a structure that can overcome numerous obstacles in its activities and eliminate these shortcomings. The management and use of water resources of such large international watercourses as the Syrdarya and Amudarya should remain in the hands of the regional interstate organization, which is the ICWC, an organization to which the countries of the region are delegated all relevant rights and authorities in this area. It defines a strategy for managing transboundary water resources in the Aral Sea basin and over the past 25 years has proved its effectiveness and necessity. As for the regime of the Toktogul reservoir, the design mode of its operation is certainly optimal. At present, in order to restore its main functions of regulating the flow of the Syrdarya and accumulating water in the bowl, the volume of non-vegetative releases from the reservoir should be increased to 3.5 - 4.5 km3 per season, and the volume of vegetative releases should be kept at 6.5, in low-water ones the same years - 7.5 km3.

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