

## **Risk management & Risk assessment of water resources of the Amu Darya river basin in the conditions of climate change and construction of large reservoirs**

Among calls that the whole world has faced, climate change poses serious threat for all natural-economic complexes including of water and ground resources. The air temperature rise at reduction of precipitation conducts to strengthening of the climate dryness. The most part of the Central Asia is in arid environmental conditions, for which poor deposits, exclusively low humidity, high intensity of evaporation and superfluous solar radiation are characteristic.

According to the experts, glacial resources in the region for the 20th century were reduced almost by 30%. The biggest Fedchenko glacier in the Central Asia Region extent from above 70km for the XX century receded almost on 1km, and on the area decreased on 11km<sup>2</sup> and lost in volume near 2km<sup>3</sup>. Don't console also the expected scenarios indicating further thawing of glaciers and change of a river drain from insignificant (5–10%) to very essential (10–40%) in the long term.

The Central Asian region is one of the most active and in the demographic plan. Annual growth rates of the population make 1.5-2%. Today in the region lives more 64 million people. It is obvious that growth of the population will lead and to water consumption growth. According to some calculations, by 2030 growth of water consumption in Central Asia will make 15–20% to compare present. In addition, resources of a natural drain in the basin of the Aral Sea are already now settled completely, and the economy of the region develops in the conditions of the increasing deficiency of water. Now their total use makes 100-110% in the Amudarya river basin. Such tendency, definitely, cannot but cause alarm. Continuation such scenarios has very serious consequences on ensuring water safety in the region. All this focuses on acceptance of urgent measures on adaptation to sharp climatic changes and steady water resources management in the region.

About 60% of the water that potentially flows to the lower Aral Basin originates in the high mountains of Tajikistan. Existing dams like Nurek and those that are under construction such as the Rogun control and regulate the annual flow regime. The demand for winter hydropower generation in the upstream countries, where the dams are located, conflicts with the summer demand for irrigation in the downstream parts of the basin. In addition, the actual available water resources are less than those considered in the official negotiations due to siltation and reduced storage capacities, and the summer runoff generation is affected by the glacier shrinkage, which has not been taken into account up to now. Thus, poor and inadequate information on the available water resources is leading to erroneous planning decisions and a biased distribution of water resources. Hence, these issues contribute to interstate transboundary water sharing conflicts between the riparian states.

To provide sustainable water management, it is important to obtain reliable information on the present and future water resources and their evolution in relation to human activities, to global changes and to climate evolution affecting the hydrological and melting regime of the main tributaries to the Amu Darya. It is not only important to know reliably what the supply will be, it is also essential to know what the real needs are, i.e. the true irrigation requirements. Hence, for good planning, verifiable information is needed of the true water demands of the irrigation projects rather than perceived demand that based on unreliable historical data and design and erroneous information.

The developed regional cooperation is one of key aspects of the solution of hydro-power problems. According to data of the Report on human development in Central Asia (UNDP, 2006) economic benefits from water cooperation in the region can annually make 5% of regional GDP. Lack of appropriate cooperation involves serious risks and expenses. According to estimation of experts losses of the region from poor control of water resources of 1.75 Bln. USD or 3.6% of GDP (The report on human development in Central Asia, UNDP, 2006).

The main problem that becomes a certain barrier in full hydro-power cooperation in Central Asia, is national policy and interests of the countries of the region. The reason consists that the countries consider possibilities of cooperation through a self-reliance policy prism energy and water resources. For effective transboundary management of the water resources more intensively regional cooperation is necessary.

In the Aral Sea Basin on the territory of which five states are located water resources used generally for an irrigation and hydropower. These water users demand the different modes of regulation of a river drain. In interests of hydropower – the greatest power generation and, respectively, use of the most part of an annual drain of the rivers in winter- the cold period of year. For an irrigation, the greatest volume of water is required in the summer, during the vegetative period. Regulation of a river drain thus is carried out by the large reservoirs. Thus, all largest hydroelectric power stations are constructed in the republics of a zone of formation of a drain in upstream of the Amu Darya and Sir-Darya Rivers – in Kyrgyzstan and Tajikistan. The main areas of the irrigated lands are located in the republics of downstream of rivers – Kazakhstan, Turkmenistan and Uzbekistan.

The question of regulation of a river drain in the region and construction of large reservoirs as Kayrakkum, Nurek (Tajikistan), Toktogyl (Kyrgyzstan) and Tyuyamuyun (Uzbekistan) in Central Asia arose from the 1950<sup>th</sup> years in connection with development of the irrigated agriculture.

What possibilities of the solution of this problem seem? Cardinal resolution of conflict between an irrigation and hydropower is not restriction of activity some one of them or submission one another, and on the contrary, their greatest joint development by construction of new large hydroelectric power stations with reservoirs of large volume. For hydropower it means increase in production of cheap and environmentally friendly energy, for an irrigation – increase of depth of long-term regulation of a drain and water security of already developed lands possibility of development new.

Existence of several water-engineering systems with reservoirs will allow resolving contradictions between hydropower and an irrigation. Today the conflict between them arises because in basins of each of two main rivers of the region-Sir-Darya and Amu Darya is available on only one large water-engineering system with a reservoir: on Sir-Darya – Toktogyl in Kyrgyzstan, on Amu Darya – Nurek in Tajikistan. The only a large water-engineering system on the river cannot carry out regulation of a drain at the same time in two modes – irrigational and power.

Construction of one more large water-engineering system on each of two rivers will cardinal change a situation. In this case, the reservoir, top on a flow will be able to work in purely power mode; the lower reservoir of the same volume will be able to overregulate a drain up to restoration of its natural mode. Especially it can provide regulation of a drain in interests of an irrigation. In the presence of numbers of water-engineering systems with reservoirs, the situation even more will improve.

The Republic of Tajikistan possesses 527 Billion kWt-h the general potential hydroenergy resources but now more than 5% are used. Therefore to expect that in near future will be built not one tens averages and large hydroelectric power stations with reservoirs. It means that at planning of the agriculture perspective development of coastal areas to reservoirs it is necessary to consider a factor of influence of water reservoirs in transformations of meteorological conditions of the district and introduction of adjustments to norms of irrigation of the corresponding cultures.