

## **The sedimentation growth endangers the water-energy-food security in Uzbekistan and Turkmenistan**

*This article is about the transboundary demo project at Tyamuyun Hydroelectric Complex and the findings achieved for the last 1.5 years of the project implementation.*

Sedimentation is a natural process that occurs in every reservoir over time. While the sediments hamper the work and maintenance of the water infrastructure, they are the raw materials formed in a natural way over decades without any artificial elements. There is a growing practice in the private sector to utilize the sediments for producing commercial products (e.g., burnt bricks, fertilizers and others). This creates an outstanding opportunity for building a win-win case on public-private collaboration to tackle environmental challenges.

Tyamuyun Hydroelectric Complex (THC) is a transboundary water-energy facility located along the Amu Darya River at the border between Uzbekistan and Turkmenistan. THC is an important facility that supplies over 5 million people living in Dashoguz Velayat in Turkmenistan and Khorezm Region and Republic of Karakalpakstan in Uzbekistan with drinking water, electricity and irrigation water to 1.2 million ha (425,000 ha in Turkmenistan and 779,300 ha in Uzbekistan). The facility is located in Turkmenistan, but belongs to Uzbekistan. The land is leased by Turkmenistan based on the legal agreements.

*Picture 1: Sedimented surface of the Ruslovoe reservoir (July 2021)*



According to the Scientific and Research Institute of Irrigation and Water Problems under the Ministry of Water Resources of the Republic of Uzbekistan (SRIWR) that conducted the estimation of the sediment volume in 2021 under the Project, the full capacity of the Ruslovoe reservoir went from 2340 ml m<sup>3</sup> per the design to 863 ml m<sup>3</sup>. Therefore, the capacity of the run-off-the-river Ruslovoe reservoir decreased by 1477 ml m<sup>3</sup> (70%) during the 42 years of its operation. It has a serious implication as highly sedimented Ruslovoe reservoir is no longer able to generate electricity at full scale and pass the water from the Amu Darya River to three storage reservoirs linked to THC (Sultansanjar, Kaparas and Koshbulak) that further allocate water for drinking and irrigation purposes to Uzbekistan and Turkmenistan.

Economic losses due to the sedimentation at the Ruslovoe reservoir made roughly USD 76 mln in 2021. By 2040 the Ruslovoe reservoir is forecasted to get fully silted as per the business-as-usual (BAU). Moreover, climate change is another factor that might accelerate the sedimentation process. Such developments would endanger the water-energy-food security for over 5 million people.

While working on the identification of the most cost-efficient technical solutions for cleaning the sediments, the project has also assessed the recycling potential of the sediments of the Ruslovoe reservoir. A range of the bioanalysis of the sediments confirmed that it contains all valuable micro elements and does not have any heavy and dangerous metals exceeding the maximum permissible concentration. The soil was found not saline and the water of the reservoir of high quality and suitable for drinking and other purposes. The bottom sediments were assessed as "poor" in humus.

The sediment of the Ruslovoe reservoir could be utilized to produce microfertilizers, biohumus, raw brick for construction and extraction of pure cobalt and other enriching works. To confirm the laboratory findings, the Central Asian Institute for Ecological Research LLP tested the recycling in practice and succeeded to produce the burnt bricks and facing tiles out of the sediments without any reagents and various chemical additives added.

Given that the Ruslovoe reservoir accumulated 1.5 mln cubic of sediments, there is sufficient materials for the private sector to produce commercial products out of the sediments if optimal technical and investment opportunities are found.

*Picture 2: Pilot recycling of the sediment at Kazakh laboratory in Almaty (March 2022)*



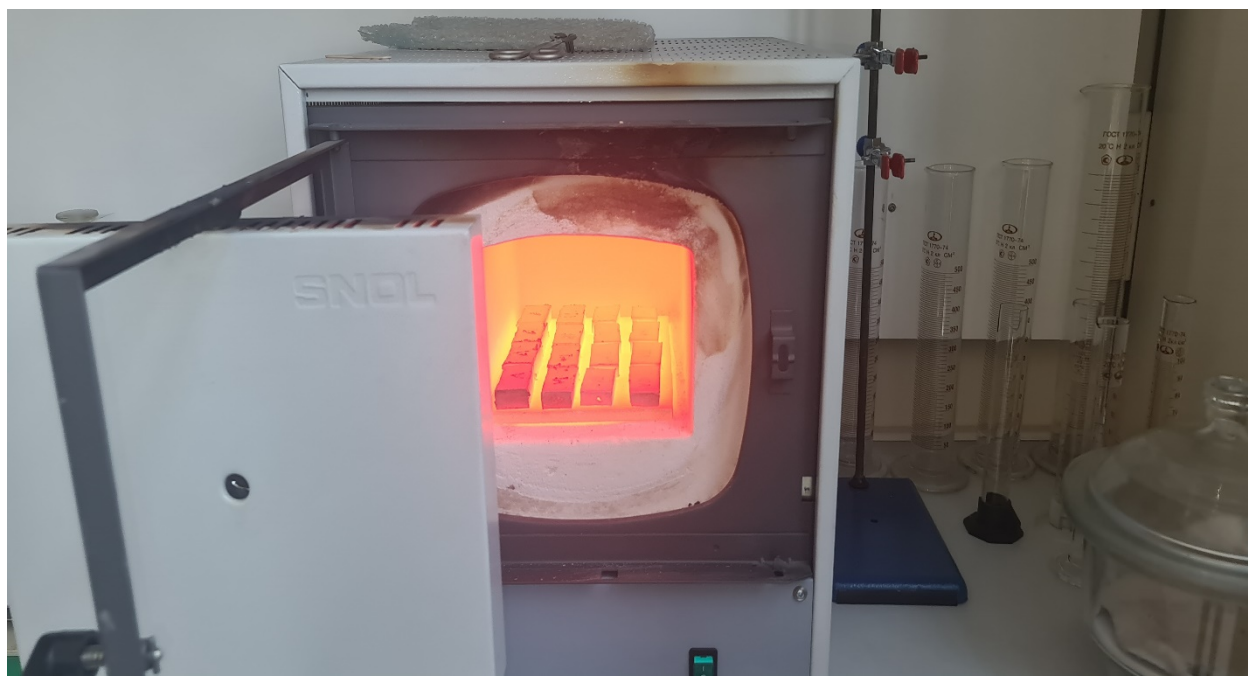
The demo project has passed many milestones for the last 1.5 years of its implementation. The most important is the identification of innovative solutions to address the sedimentation challenge at the Ruslovoe reservoir. The remaining half a year before the end of the project will be dedicated to the finalization of the technical solutions on how to clean the sediments from the reservoir. Until now, the national and international experts have come up with around 10 technical suggestions that include different technologies and vendors. Moreover, a cost and benefit analysis (CBA) will be done to support the decision makers in their conclusions on the investments required and the technical solutions identified.

By the third quarter of 2022, a specific investment proposal on the technical solution(s) for cleaning and recycling the sediments at the Ruslovoe reservoir will be developed, submitted for approval to the relevant authorities of the riparian countries and proposed to the private sector, IFIs and other potential investors. Apart from the transformative approach that the demo project brings to the region, it also advances the transboundary cooperation between the riparian countries to join the efforts to enhance the water-energy-food security for their citizens.

Overall, the demo project's findings have been achieved by a group of the consultants under the leadership of CAREC that include the Scientific and Research Institute of Irrigation and Water Problems under the Ministry of Water Resources of the Republic of Uzbekistan, LLP Central Asian Institute for Ecological Research, international consortium of consultants SIM, HYDRO, HydroNova, Norwegian consulting company "Deltares", German consulting company "Altus Impact" and USA consulting company "Tipping Points Solutions" as well as such national experts and coordinators as Georgiy Kurtovezov and Merdan Karayev from Turkmenistan, Ilkhom Jurayev, Kurbanbay Babadzhanov and Kamol Kuchkarov from Uzbekistan.

The deliverables produced so far under the demo project can be freely accessed at this [link](#).

*Picture 3: Succeeded laboratory experiment on producing the burnt bricks at the Central Asian Institute for Ecological Research LLP (May 2022)*



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**Photo credit:** National experts of the demo project

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