

LET'S RETURN RIONI RIVER TO KUTAISI

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Technical proposals for implementation of Rioni HHP (HPP) in a completely new way are reviewed. According to the plan developed by the author, it is possible to have three hydropower plants with the total capacity of 55 MW including one 35 MW hydropower plant with the dam and two one-type run-of-river hydropower plants with 10 MW capacity each. At the same time, 15 MW capacity of Gumati HHP 2 are lost.

Practical recommendations for implementing Rioni HHP according to the suggested plan are provided. Construction can be financed by Kutaisi infrastructure, local budget and the sources attracted from energy sector. Perspective drawing of the reviewed scheme is provided.

Key words: *water turbines, diversion, dam hydropower plant, headwork, reservoir.*

Construction of Zemo Avchala and Rioni HHPs became the basis for Georgian energy at the beginning of the 20th century. Decisions of engineer A. Melik-Phashaev and Professor A. Ludin were indeed advanced at that times. Energy services provided by these two hydropower units significantly contributed to the development of the country's economy.

Kutaisi, west Georgia regions, Zestaponi ferro-alloy plant, Transcaucasia electrified railway and many other fields of the national economy were supplied by power of Rioni HHP in 30ies of the last century.

Rioni HHP uses the energy of the most high-water Rioni river within Kutaisi. Although, more than 80 years have passed since putting the hydropower plant into the operation and the unit is still operating with certain problems though.

Three main groups such as headworks, motor facilities and diversion structures are characteristic for Rioni HHP as for typical hydropower plant operating on a river flow. There is no pressure drop of Rioni river observed within the Kutaisi section. In order to increase the capacity, the necessity of the diversion structures supplying water to the motor facilities within the 10 km distance arose at Rioni HHP complex.

In current economic development in Georgia the contribution of Rioni HHP to the country's power supply became insignificant. Today, power supply from local to the global scale is not a problem and it is promptly performed by means of power channels. Also, it is possible for Georgia to become energy exporter in the near future.

So, the energy policy has been transformed – Rioni HHP has lost its primary function.

Today's reality with respect to Rioni HHP is characterized by different priorities, in particular, ecological problems of Kutaisi take the first place. Rioni HHP left the city without water at its entire length, did not consider the interests of local residents, and had an impact on the environment. All the above mentioned is considered to be certain aggression on the nature.

There was no protest expressed about the construction of the hydropower plant at that times, just the opposite, the population celebrated its construction. Power supply for Kutaisi residents was the priority issue at that times. Even just lightening was luxury for a small city, and from today's view breaking of ecological balance for Kutaisi is obvious.

At present, the operation of Rioni HHP is conducted with number of negative processes, in particular: diversion due to the landslide areas of the trace cannot be considered to be solid, there are problems in the diversion tunnel and motor facilities reducing the energy and economic indexes not mentioning the physical and moral depreciation of the structures and electromechanical equipment. Except for the above mentioned destructive cases, Rioni river within the Kutaisi section is used irrationally.

The city has been naturally extending within many years and consequently the scale of negative facts increases which is conditioned by leaving the city without water. First of all these are hygiene and sanitary, esthetic and ecological conditions.

Given this, the conclusion is that Rioni HHP as the diversion hydropower plant has lost its primary importance and has suffered technical and moral depreciation.

New, alternative, complex plan of complete reconstruction of Rioni HHP and effective use of Rioni river within Kutaisi is prepared by us.

According to this plan, the structures of Rioni HHP headworks: power intake, siphon spillway and active raftway in the dam section will be liquidated. Blind ground dam will be constructed to the concrete dam from the tail water. Generator station building participating in Rioni backup and hence, in the creation of the reservoir will also include surface spillway structure for decreasing the weir front. Modern fishway structure will be arranged here as well.

In Georgia the fishway is constructed only at Zemo Avchala HHP, but it is not functioning. Fish, as economic treasure of the country is not fully used. We should not forget that fish is unvalued natural resource of the country. New water turbines with horizontal axis which have high water passage and hence more capacity and efficiency will be installed in the hydropower plant building. Instead of antifiltration diaphragm the existing concrete dam will have the function of the ground dam screen. Basic structure of new Rioni HHP will be located compactly and this will make the operation at Rioni HHP significantly easy and reduce the operation costs.

Elevation of the ground dam is defined by the tail water level of Gumati HHP 1 giving 19m of the backup elevation, i.e. the level of the existing hydropower plant backup will elevate by 6-7m. The estimated consumption of new, reconstructed Rioni HHP is accepted to be 200 m³/sec and the hydropower plant capacity – 35 MW. Surplus water unused by the hydropower plant will be accumulated in newly constructed reservoirs and in Gumati HHP 1 reservoirs within the range of their capacity.

According to the presented plan the building of the generation station and some hydraulic structures of Gumati HHP 2 will appear within the flood zone. 15 MW will be actually lost as a result of the liquidation of hydropower plant.

New Kutaisi reservoir will create problems for the population of the lowland and infrastructure extended over the right bank of Rioni river. It will be necessary to construct proper height dike along almost the entire perimeter of the west bank of the reservoir. The necessity of population's exile may arise as well.

Under the suggested plan, instead of diversion, already depreciated Rioni HHP we will have the reconstructed dam-type hydropower plant which will be analogous to Irkutsk hydropower plant constructed on Angara river in 50-60ies of the last century. By implementing our proposal, Rioni will return its natural function and participate in the prosperity of growing, economically and politically developing city and will change its landscape to the better.

From energy point of view, the reconstructed Rioni HHP will be capable of operating under daily (even in incomplete) regulation conditions within the range of efficient reservoir capacity. Water reserve and an increase of the reservoir level will allow to supply technical water to the plants and population of the city.

On the second stage of the reconstruction, it will be possible to use the energy of Rioni river within the city like the energy of Ortachala HHP type using run-of-river structure. Coordinated hydropower system will be created by low threshold extensible dams and new type water turbines with horizontal axis that have high water passage and high energy and economic indexes will be installed there. 10-12 m pressure drop within this area of the city allows to get extra 20 MW power with 2 low pressure hydropower plants. Such hydropower plants are more efficient than the run-of-river hydropower plants located to the dam. They are popular in such leading European countries as France, Austria and Slovenia.

Water used in the water turbines of the reconstructed Rioni HHP will fill up the old river bed of Rioni. Rioni will improve sanitary condition of Kutaisi, clean and fresh air will make demographic situation better. In addition, the original landscape will be recovered. In order to maintain elevated water level in Rioni, it will be necessary to construct the coast walls on the both banks of old river beds. Pond level of water will provide well-organized main water line which will make Rioni suitable for navigation. Sewage headers for removing sanitary sewage will be constructed along the coast walls. Perfection of the road communication and connection of two main regions of the city by highway bridges will be possible too.

Ensemble of intended hydraulic structures will open way to the construction of contemporary city which will totally change the view of Kutaisi.

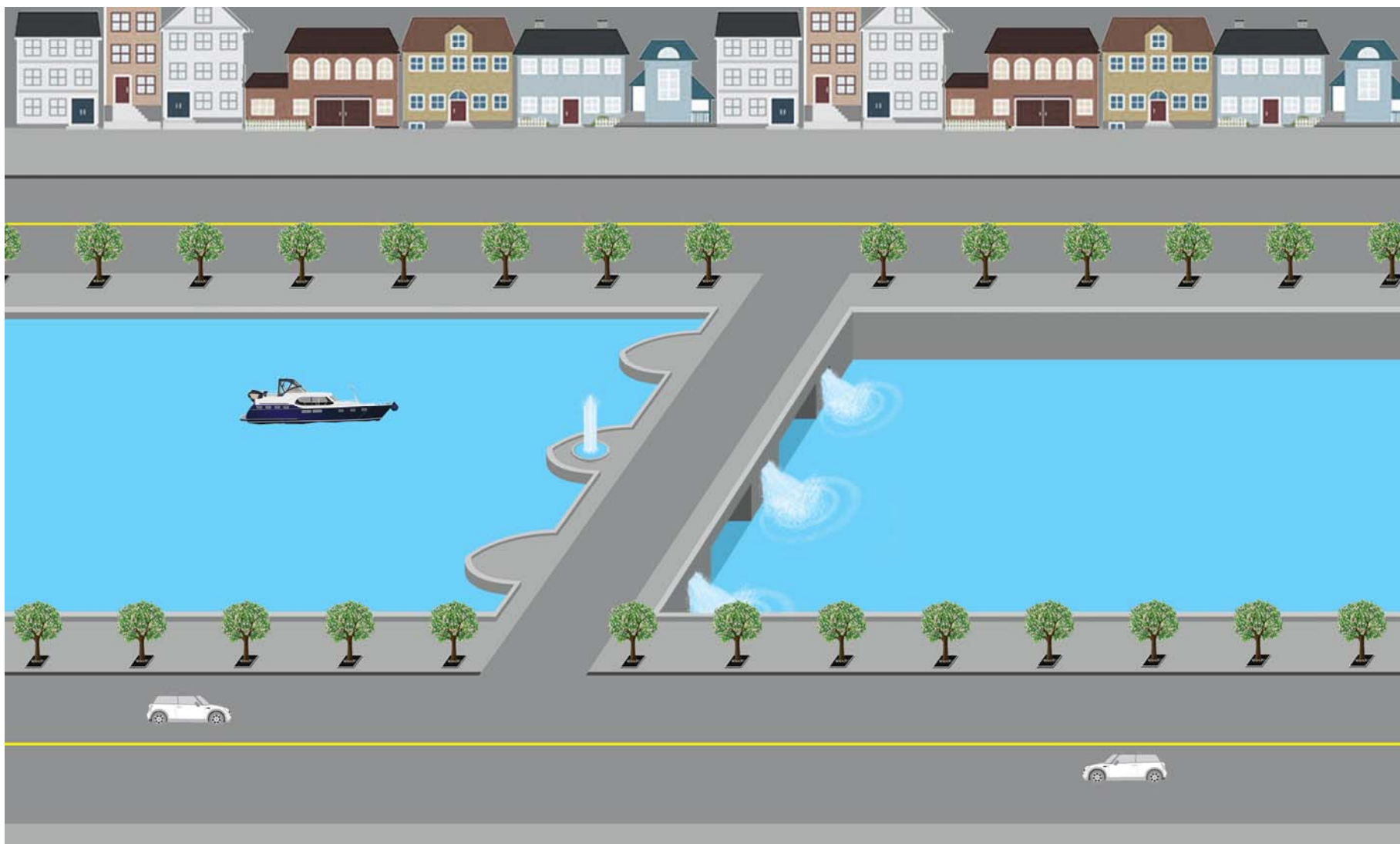
As a result of the reconstruction of Rioni HHP the area occupied by the diversion channel, pressure reservoir and other structures on Sagoria plateau, approximately 30 hectares of the land will be released.

So, by dismembering of the diversion-type Rioni HHP we will get three hydropower plants with the total capacity of 55 MW including one 35 MW hydropower plant located at the dam and two one-type run-of-river structures with 10 MW capacity each and 20 MW in total. Instead of 15 MW capacity of Gumati HHP 2 we will get contemporary reliable power units. Considering the presented views, the energy losses will be insignificant.

Rioni HHP like Gumati HHP system is currently alienated by the government making the implementation of our proposal difficult. Hydropower plants in many leading countries are owned by municipality: Great Britain, Norway, Australia, in some countries the authorities managed to nationalize alienated hydropower plants (Mexico, 1960). In this direction it should not be excluded that the population of the city and its local management obtain independent decision from central authority about the implementation of unprecedented project in the world for the purposes of realization of their interests.

The construction can be financed by local budget (basically by the city infrastructure), from one hand and the attracted sources (energy), from the other hand.

Perspective picture of the proposed plan is provided on the drawing.



Drawing. Kutaisi. 2015.