

From Nurek to Rogun

(Tajik scientists object to Leonid Papirin)

Famous soviet engineer N.A. Karaulov back in 1932 while considering hydro energy resources of Tajikistan showed enormous opportunities of the country on generating electricity. I think it would be interesting for readers to get acquainted with an excerpt from the article by N. A. Karaulov published in 1932: “...the total power of the installations which are planned to be constructed on the rivers of Tajikistan is distributed as follows: the Panj River system - 26%, the Vakhsh River system - 53%, Kafirnigan - 3%, Karatag - 3%, Zarafshan - 16%. The total amount of power produced by all of these plants is coming up to 22 billion kWh”.

This figure which seemed fantastic for those technological innovations of hydropower construction of that time is past the point of Tajikistan. At present the country produces annually more than 16 billion kWh and according to B. Sirodzhev’s opinion, the river Vakhsh itself can technically generate 45 billion kWh of electricity per year. The Vakhsh River basin which has 39 400 km² catchment area is located in the highest part of Tajikistan, in the Pamir-Alai Mountains foothills.

Thanks to N. A. Karaulov’s works the Vakhsh River from early 30's became a major object of regard of scientists, researchers and hydropower engineers that led to construction of hydroelectric power chain on the Vakhsh River. Currently there are seven hydroelectric power plants which have being successfully operated with total installed capacity of 4670 MW. They provide 93% of electricity production of the country. Nearly three quarters of electricity is produced by the most powerful Nurek HPP which has the highest dam at 300 meters and generates 11, 2 billion kWh per year. Designing of this plant began in 50’s and its construction was started in 1961. Nurek HPP was accepted for operation in 1972, its last ninth unit was commissioned in 1979. The reservoir’s area is 98 km², its volume and length are 10 km³ and 70 km respectively. B. Sirodzhev as a former Head of the “Tadzhikglavenergo” entity in his response to journalists says, “There was the most stringent quality control during construction of the Nurek HPP. There were special units for monitoring of the construction activities quality, equipment checkout and other works. No deviations from design considerations were allowed. While accepting each phase the contracting companies had submitted their work to both customer and project organization. And only after this they could receive payment for the work performed. Thus, any irregularities in the construction process were excluded”. Such a high Nurek dams a rock-fill dam that improves its

resistance and reliability. During 37 years of existence the dam had settled down nearly for three meters, which means that it has stabilized, and water filtration through the dam has become lower by half, now it is 37-67 liters per second instead of designed 80 liters per second. That is why our scientists stand for rock-fill dams from local materials. All these years the Nurek HPP caused no concern. We have only to monitor carefully its proper operation. Installed seismic sensors had showed the increased seismic activity during reservoir filling. However, the earth shocks were weak and such constant seismic movements only strengthened the dam without causing any serious accidents.

Attack of Uzbek ecologists and opuses of Soviet writers

The current broad scale attack of our neighbors' environmentalists towards construction of Rogun HPP reminds me of an incompetent report of a number of major writers led by Marietta Shaginyan featured in the "Pravda" newspaper in 1962 against the construction of the Nurek HPP high rock-fill dam. In response, on the front page of the "Pravda" there was published an article of well-known scientists of international fame M.V. Keldysh, A.N. Nesmeyanov, A.M. Sadovskiy, A. P. Alexandrov and others, who asked journalists and writers do not interfere in purely scientific and engineering projects.

After reading a number of statements of our opponents asserting that for the last 100 years in the Rogun construction area there had been 20 earthquakes with a magnitude of 9 points, we turned to the well-known seismologist, Academician S. Kh. Negmatullaev and asked to give us the background on seismic condition of the Nurek and Rogun HPPs construction area. The scientist has presented database tables of all the earthquakes that have occurred on the territory of Tajikistan for the period from 1895 to 2010 and the strongest ($M > 6,1-9,0$) deep earthquakes for the period from 1906 to 2010. A thorough data review has showed that the earthquakes with an intensity of more than 6 points on the MSK scale have never been recorded in the construction area of these high-altitude dams. During this period 30 earthquakes took place on the territory of Tajikistan and 38 earthquakes happened in Pamir-Hindu Kush zone outside Tajikistan. All the data are specified in different directories which are available to our contradictors and all persons concerned.

B. Sirodzhev states, "The accident which occurred on August 17th, 2009 at the Sayano-Shushenskaya Dam in Russia has recalled the need for a more critical approach to the safety of existing and being built hydraulic structures". There were a lot of discussions on this subject and they continue up to this day. Yes, indeed, the giant national Nurek HPP has a thirty-seven-years accident free working history, but this is not to say that it would last eternally. Of course, there is a need

to convene a competent expert group for identifying the plant's damaged areas. It is necessary to engage the qualified personnel in order to avoid what happened in Russia. Indeed, the shortages in the operation and maintenance of the technical control were one of the stated reasons which caused that accident. It should be emphasized that the Nurek HPP was not the last one in the hydroelectric power chain on the Vakhsh River. The next one was Rogun HPP, which had to be built to extend the operation term of the Nurek HPP. The matter is that the Nurek reservoir is gradually silting due to deposits, which are applied with water. Rogun reservoir will protect the Nurek HPP's reservoir from the siltation. Besides, there is another problem for the storage of large volumes of water with a high dam –it is so-called “dead volume” which is amount of water that eventually must be replaced by siltation.

The “dead volume” usually makes up at least half of the total volume of the reservoir. For instance, if the gross storage capacity of the Nurek HPP is about 10,5 billion m³ than its “dead volume” is less than 6 billion m³, or about 60%. Silting of the Nurek HPP's reservoir and existence of the “dead volume” of water begins to seriously affect the electricity production, especially during the winter months.

All these challenges put before the Government of the Republic of Tajikistan the issue of resumption of the Rogun HPP construction. The construction of the Rogun HPP was restarted in 2000. Presently the task is to put into operation the first phase of the plant consisting of two units in the coming years. There are all prerequisites to do so. Thus, almost two units are ready for erection in the storage facilities of the plant. Turbine equipment has undergone examination of the “Turboatom” specialists in Russia and is accepted for further installation and operation. Certainly, during construction other issues will arise. As a rule, further construction requires support of a design institute. Our general design engineers in Tashkent have denied us to do it, so the Government of the Tajikistan had to appeal to the Moscow “Hydroproject Institute”, the former head office of Tashkent “Hydroproject”. One of the items, according to which work the Moscow specialists is, “Hydroproject” shall have the right to correct technical solutions for the construction of hydroelectric complex in the case if their further implementation provide the required level of safety, as well as in the case of unjustified optimization with the approval of customer”.

At present there is ability to quickly recover the seismological monitoring based on advanced technologies. There have been created a regional network consisting of seven broadband digital seismic stations with satellite communication of the “Nanometric” company. The geophysical service of the Academy of

Sciences of the Republic of Tajikistan was established. Preparatory work on creation of local network based on modern digital seismic stations for monitoring the Rogun HPP area is being conducted. It should be emphasized that observations of the turbine room shifting never stopped and it is positively to note that deviations over the last fifteen years were within the limits specified by project.

Now construction of the Rogun HPP has become the most urgent and pressing task for Tajikistan and preparation for the Vakhsh River closure is carried out by the required momentum. Rogun HPP is a part of the Vakhsh hydroelectric power chain. As its upper stage, it is a barrage power station with tall (335 m) rock-fill dam. The design capacity of the HPP is 3,600 MW; average annual output is 13.1 billion kWh. In the power house there must be installed six radial-axial hydraulic units each with a capacity of 600 MW. Dam should form a major Rogun reservoir with full storage of 13,3 km³ and working storage of 8,6 km³. The reservoir will be used in both energy and irrigation purposes to irrigate arid land area of 300 hectares. The hydropower plant is planned by several stages. Power of the first stage should be 400 MW with average annual output 5 billion kWh. The cost of the construction completion is estimated at \$ 2,2 billion, first stage is \$ 590 million.

Currently, the hydropower plant is adjusted by the Russian “Hydroproject Institute”. Opponents have criticized the project because of its location in the zone of high seismic activity, landslides and debris flows, as well as the Ionakhsh tectonic fault filled with rock salt which is located right under the dam basis. Engineers claim the dam safety, in particular about the fact that its construction is earthquake-resistant. Along with that, special events are scheduled for the protection of rock salt deposits from tearing.

In 1974 the Rogun project developed by Tashkent “Hydroproject” Institute was approved by the USSR Gosstroy. Soviet hydropower engineers found safe solutions for all the mentioned shortcomings. There was provided 63 km tunnel boring. According to the project for combating the salt forms there had been envisaged the use of special technology providing a reliable level of safety, i.e to compensate the water storage pressure the layer would be given a saturated salting liquid. To build a solid shake proof dam was made the decision to put it up with a complex structure of loam, gravel and stones.

Preparatory period of the HPP construction was initiated in 1976. In September of 1976 first builders arrived in Rogun. Transformers and turbines began to be made in Kharkov, hydro generators had to be manufactured in Sverdlovsk. Totally more than 300 enterprises were involved in the project. For

the plant builders there was built town of Rogun with multi-story buildings and the entire infrastructure. In December 27, 1987 the Vakhsh River was closed and construction of the dam was started. By 1993 the height of the upper coffer-dam has reached 40 meters, by that time 21 kilometers of tunnels were passed, main work on the development of turbine (70%) and transformer (80%) rooms was performed. After collapse of the Soviet Union construction of the HPP was suspended. On 8th of May, 1993 the upper coffer-dam was washed away by a powerful flood-flow, tunnels and turbine room were partially flooded.

In 2004 there was signed an agreement between the Government of Tajikistan and “Rusal” company on the further construction of the hydro power plant. The feasibility study of the project was funded by “Rusal” and a number of works on the HPP site were carried out. However, the parties failed to agree on some fundamental features of the project, in particular, height of the dam, as well as its type (“Rusal” offered to construct a concrete dam 285 m. tall) and in September 2007 Tajikistan officially terminated the agreement with the company.

The Vakhsh River closure has been scheduled for December 2009 but then was postponed. Start-up of the first stage consisting of two units with total capacity of 400 MW should be implemented in late 2012.

In December 2010 the works in the first building tunnel of the plant were completed. In 2010 the Republic of Tajikistan and the World Bank signed an agreement on an international project expertise; in February 2011 Swiss company “Poyry Energy LTD” and French firm “Coyné & Bellier” were selected as contractors for carrying out expert examination.

This was a brief history of the Rogun HPP construction. Now comes the final stage of examination and soon the question of Vakhsh closure and erection of first stage of the dam and installation of the first two units will come up.

Myths about Rogun’s dangers

According to many experts and specialists of Uzbekistan, construction of the Rogun HPP can lead to serious dissidences in the Central Asian region regarding the use of transboundary rivers flow. They believe that much of the water, which should fall into the lower reaches of the Amu-Darya, will remain in Rogun water storage.

Some authors have suggested various alternatives instead of Rogun HPP construction. One option which has been promoted and thoroughly discussed is the construction of hydropower plants chain on the Bartang River flowing out of Sarez

Lake. The lake was formed as a result of natural disaster, when the river was blocked by Usoi natural dam in 1911. Currently, the volume of water in the lake is 17 billion km³, depth is 500 m. (deepest point) and the length is about 70 km.

Usoy Dam which forms the lake is almost twice as high as the planned Rogun dam. And the volume of Sarez Lake half as much again than expected Rogun HPP's water storage volume.

Experts are also very concerned about the issue that construction of Rogun HPP will demand all the resources of Tajikistan, including financial, resulting in a fact that solution of Sarez problem would be indefinitely postponed, perhaps for decades. And during this period failure of the Usoi dam may occur. Thus, we have being insistently pushed to abandon Rogun HPP construction.

In this regard B. Sirodzhev in his current article "Rogun HPP as a guarantor" (Asia-Plus, № 77,12th of October, 2011) objectively expresses the following opinion, "... there's no need to dramatize issue around the reservoir filling. We need 15-16 years to accumulate the total storage capacity, filling the reservoir only in high-water years. In this case power plants of the republic will operate normally and farmlands from lower reach of the Amu-Darya will not be damaged." And then the author makes remarkable conclusion, "Only Rogun reservoir can fully regulate the Vakhsh River. With adjustable water volume of 8,600 million m³ it together with the Nurek HPP would be able to prevent all natural disasters in the region. We can confidently state that the Rogun HPP acts as a guarantor of energy production by the whole Vakhsh hydropower plants chain and irrigation of lands located in the lower reach basin of the Amu-Darya".

We do not understand the reasoning of individual experts who have one goal - to stop the construction of Rogun HPP, resulting in the fact that Tajikistan would be energetically dependent on its neighbors, will not develop industry and its population would be in poverty and complete dependence on the work of hundreds of thousands of our migrant workers in other countries. These experts are trying hard to argue about necessity and feasibility of the priority attention to the problem of Sarez Lake rather than construction of Rogun HPP. However, in some reasoning of these experts exists a logic sense, but it can take us away from the main task of the Government of Tajikistan which is to achieve our people's welfare, increase GDP growth, cut down our debt to foreign countries and develop the country's industrial potential .

Here is a fragment of the arguments offered by these experts:

“...It should be noted that the Rogun project is fully commercial. Sarez project in case of its implementation will be considered more humanitarian and social since its main aim is to reduce the risk of the Sarez lake outburst and exclude the possibility of environmental and humanitarian disaster in the region. Power producing as part of this project is only an addition to more effective use of the lake’s potential. As a consequence, Sarez project can attract investments from around the world and from all humanitarian organizations including the IMF, UN, etc. Thus, it is possible to redirect the Rogun funds and joint use of financial resources which are already offered by the various funds to address the problem of Sarez Lake”. And further, “... parallel reclamation of undeveloped territories of Tajikistan with the possible establishment of mining industry and development of ski tourism later in this region or “Sarez Project” may attract more labor resources to Tajikistan because of the need to develop infrastructure in that regions of the country” etc. By accepting this project on Sarez the energy crisis in Tajikistan may exist for decades and lead to disastrous results. Rogun is a direct path to success.

“Today none of those who have the slightest idea of hydroelectric power do not believe in myth that the Rogun construction threatens environment and the Aral Sea, which is spread by some authors from Uzbekistan”, says Leader of the Communist Party of Tajikistan Shodi Shabdolov. According to him, the discrepancies that emerged in the region around the construction of Rogun HPP are clearly politicized and in reality there is a struggle for leading position in the energy market of Central Asia including Afghanistan, Iran, Pakistan, India and even Russia and China.

Concerning the problem of Aral, Sh. Shabdolov said that it arose through no fault of Tajikistan. “Water resources of the region intended for irrigation in the lower reach countries have been used very inefficiently, in some cases the losses reach unacceptable values, and the main irrational user of water in the region is Uzbekistan and this axiom is known to all those who at least by hearsay is familiar with the problem of the Aral Sea drying”, says leader of the Communist Party of Tajikistan.

According to Sh. Shabdolov, Rogun HPP construction will benefit not only to Tajikistan but also to other countries in the region, as in the next 50 years the world will face a severe shortage of oil and gas, as well as drinking water. “Pseudo-experts do not take into account that presently Afghanistan almost never uses its share of water withdrawals from Panj and Amu-Darya Rivers, but soon will come the day when in order to irrigate its great spaces our neighboring state will demand fair share of water resources of the basin. That’s when the vital

importance of the Rogun reservoir's water, which subsequently could be used by Uzbekistan, Turkmenistan, will grow by hundreds of times", notes Sh. Shabdolov.

The main arguments in favor of Rogun HPP construction are the following.

Tajikistan having large energy resources always suffers from the lack of electricity. The most powerful energy facility in the country is a chain of hydroelectric powers built on the Vakhsh River and inherited from the Soviet Union can not cover all the energy needs of the developing state. As the experience of recent years shows, electricity shortage in the country is felt more acutely. This was especially evident in recent years in the coldest winters of 2007 - 2008 and 2011-2012. That is why Tajikistan considers the possible options to strengthen its energy security. The most effective one is the Rogun project. In favor of Rogun HPP can be supplied the reasons that motivated not only design engineers, but also the Government of the Republic of Tajikistan:

Nature itself has created a unique environment for construction of the high dam without prejudice to flood fertile land in the Vakhsh basin and improvement of the opportunities for irrigation in the lower reach land - it is bend of the Vakhsh River and convenient place for the plant construction, as well as huge gorge where small amount of populated villages and fertile land is located;

The effluent tunnels for the Vakhsh River closure are at the final stage of construction;

A thorough long-term investigation of seismic condition of the dam location has been carried out. It is proved that during the existence of seismic measurements earthquake intensity level never exceeded 5 – 6 points magnitude according to the MSK scale, and the project is figured on 9 points;

The dam is being built stage by stage; it is being filled with loam, gravel and stones, which makes it resistant to possible earthquakes. The first 110-meter-high stage allows installing of two units each with capacity of 600 MW, which in turn will remove the growing electricity shortage in our country.

The remaining units will be installed progressively as the dam would be constructed allowing to sell surplus energy to the neighboring countries, i.e the energy security of Tajikistan will be ensured;

The reservoir will be filled within 15-16 high-water years and the Amu-Darya lower reach countries will not be damaged;

When reservoir would be entirely filled the water can be used for irrigation of an additional 300 thousand hectares of arid land in the lower reach countries of the Amu-Darya basin;

Rogun's reservoir will keep to a minimum the risk of water shortage for the lower reaches of the Amu-Darya, especially in drought years;

Rogun's reservoir will extend the operation term of the Nurek HPP almost completely reducing the process of silting up of its water collecting area.

Thus, Rogun HPP is the most important object of the hydropower plants chain on the Vakhsh River, this project is a single source to bring Tajikistan through severe energy crisis; moreover, it will facilitate the creation of new irrigated productive bally crops in the lower reach.

With regard to Sarez project, I am totally confident that in the near future while accumulating sufficient funds for putting the lake in safe condition, laying roads in this mountainous region, construction of settlements for builders and engineering staff, development an appropriate infrastructure we can seriously begin to address these issues. To date in order to ensure timely evacuation in the event of an alarm situation there is created a unique system of monitoring and early warning on the lake, which is operating thanks to the assistance of international organizations under the guidance of the World Bank. The system provides early warning for neighboring countries, too.

I am convinced that solution of this enormous problem should involve our nearest neighbors which means all the states located in the basin of the Panj and Amu-Darya Rivers.

Professor Dzhonon Ikrami

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