SOME OPINIONS ON THE DEVELOPMENT OF HYDROPOWER

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Work [1] caused a discussion even while it was being prepared for press, and therefore the author considers it necessary to answer the questions that arose.

Concerning Hydropower and Its Place in the State. First of all, not one of the statements in [1] belittles the achievements of our hydropower industry or services of scientists, engineers, and economists who labored to substantiate, design, or construct our hydropower giants. On the contrary, one of the "internal," not directly expressed in the text, purposes of [1] was to explain the causes of undervaluation of hydropower in the USSR as the most important natural productive force of the state and the waning of hydropower construction since the start of the 1960s.

Although in the words of B. L. Érlakhman "by the efforts of leading scientists, engineers, and economists" it was possible "to substantiate the need for the priority place of hydropower," it must be recognized that actually it did not occupy such a place in the USSR.

As far back as the GOÉLRO (State Commission for the Electrification of Russia, 1920) plan the focus was on the primary development of thermal power, and hydropower was given only the function of supplying electric power to regions where there was no fuel but there was a river stretch. The compilers of the plan even pointed out in advance that what was said in the plan "should not be interpreted as a negative attitude toward the use of water power in the Russian Republic" [3, p. 68].

A comparison of the hydropower program of the GOÉLRO plan with the 1909-1917 planning documents that preceded made it possible to establish a difference of their concepts [3, pp. 63-64]. In the prerevolutionary plans hydropower arose as if by itself, as a consequence of improvement of the navigation conditions of rivers by locking with the creation of a water-transport system covering the entire country. Conversely, GOÉLRO regarded a hydroelectric station exclusively as an enterprise for the production of electric power. GOÉLRO did not regard a river as a whole and the more so as an integral part of the whole of a higher order (water network).

Such an understanding of a hydroelectric station and river on which it is being constructed did not change during the past decades. Therefore a hydrostation (including its dams and reservoir) were compared with a thermal power station, and even under conditions when a cascade of hydrostations was planned the economic indices were calculated not for the cascade as a whole but separately for each reach, conclusions were made about the "ineffectiveness" of a particular reach, etc.

It is unlikely that such an approach is possible further. The legislative acceptance of Basin Agreements as the basis of coordination of water-management activities ("Water Codex of the Russian Federation," p. 120) predetermines planning of water-management measures (including streamflow regulation by reservoirs with utilization of water power) for the river basin as a whole. At the same time, in view of the presence in the country of interbasin connections and possibility of their creation in the future, Interbasin Agreements should also be legalized. In turn, a general program of regulating, utilizing, and protecting water resources of the Russian Federation determining the final goal of the state in this area and the sequence of its achievement is needed for coordinating water-management activity within the frameworks of the Basin and Interbasin Agreements (such programs exist everywhere abroad).

Just as such a program necessarily should provide for streamflow regulation by reservoirs, so it is suggested to construct without fail hydrostations at them so that in all cases of creating a backwater by artificial structures it is possible to utilize its energy and so that each release of water from the reservoir generates electricity, saving fuel.

In other words, the approach to hydropower should be not from the aspect of the fuel and energy complex but from the aspect of water management of the state. For example, a thermal or nuclear power station will not protect citizens and their property from flooding; a reservoir will protect from it, but there should be a hydrostation at it without fail with all its benefits for the fuel and energy complex.
Precisely in such a context "it is advisable to regard a hydrostation as an enterprise as part of a complex for solving the general problem of multipurpose regulation of inland waters of the state (communities of the state) [1, p. 44].

**Concerning No Alternativity of Hydropower.** Nowhere in [1] are "no alternativity of the design variant" and "repetition of any substantiation of a hydrostation or tidal power station" asserted. Designing indisputably should be variant with appropriate comparisons, but only a thermal power station cannot be an alternative of a hydrostation: they are physically different, the economic possibilities offered by them are different.

In general, as experience shows, the only real alternative of a hydrostation is simply rejection of its construction, the consequence of which can be used for each particular case, but especially harmful is the rejection of the construction of hydrostations at various reservoirs.

For example, the Krasnodar hydro development on the Kuban River, which is presently in a prefailure state, is listed on the balance of the State Water-Management Committee of the Russian Federation and, not having a hydrostation as part of the structures, for covering its own electric power needs (including for operating drainage systems with artificial pumping of water protecting considerable territories from subirrigation) buys it in the interconnected power system.

Evidently, the ineffectiveness of a hydrostation as part of the hydro development was "proved" in its time as a result of comparison with the alternative thermal power station. Today the alternative variants are such: disconnection of the hydro development from the power supply (for debts) will lead to a large-scale catastrophe, whereas a hydrostation as part of it could not only cover own needs but also bring in considerable income from the sale of electricity to outside consumers. Which of the variants is economically preferable?

It seems that this example rather convincingly confirms the thesis "about the advantage of using the energy of any backwater of rivers."

**Hydrostation or Tidal Power Station** — such opposition is absent in [1], since tidal power stations (TPSs) are not mentioned there at all. Unlike a hydrostation, a TPS does not offer the economic opportunities related to impounding a river [1, p. 43]. In this sense a TPS (unlike a hydrostation) can be functionally equivalent to a thermal power station with corresponding capacity and production.

But even then it is necessary in each particular case to study the possibilities of the multipurpose use of the structures of the TPS:

1. Cutting off from the sea the basin with the rivers emptying into it, the structures of the TPS can help control floods on them by reducing wind setup similar to structures in the Gulf of Finland for protecting Leningrad. It is opportune to mention that an integral part of this complex should be a hydro development on the Neva River. Apparently, the cost ineffectiveness of a hydrostation operating on the runoff naturally regulated by Lake Ladoga was "proved" and as a result it was decided to reject its power production and at the same time to reduce the technical effectiveness of the flood-control complex.

2. The basin being cut off from the sea is protected by structures of the TPS from waves and can serve as a port (navigation structures should be provided).

A thermal power station cannot provide either of these functions, which is why not a thermal power station but rejection of a TPS and the additional functional possibilities offered by it turns out to be the alternative of a TPS.

**Concerning "Return of Capital by Means of Income."** In the words of Erlikhman, "instead of the payback period of additional costs of one variant compared to another, it is recommended to us to take the time of return of capital by means of income in one or another variant, for example, 5% for a hydrostation and 15% for a tidal power station." Unfortunately, it is not clear to whom and where such a recommendation is given and how binding it is.

We note that problems of selling the product (electricity), prices, rates, incomes, etc., are intentionally not examined in [1]: these are not engineering but commercial problems whose solution is determined by the state economic policy and market conditions.

Determination of capital investments and operating expenses for competing, functionally equivalent variants and their comparison in the form of generalized indices calculated by a certain method are engineering tasks. In [1] the method of reduced expenditures is rejected as fundamentally defective and the method of "arbitrary-actual expenditures," proposing summation of capital investments and operating costs during a certain sufficiently long period is proposed; it was shown that there is nothing new in it; exactly the same is used abroad and was used in Russia at the start of the current century.

The proposal in no way rejects calculating the payback period of additional investments by the difference of operating costs of the compared variants [1, p. 46, formula (2)].