THE REAL PROSPECTS FOR POWER SUPPLY OF THE EASTERN PART OF THE COUNTRY LIE ONLY IN HYDROPOWER

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The general trend of development of the energy base of the country in the direction of a decrease of the construction of nuclear power stations and increasing difficulties of fuel production and disposition of thermal power stations necessitates the active use of renewable energy resources, especially the most technically developed ones — hydropower resources. In the Far East the possibilities of their development are commensurate with the total energy requirements of the region. The most considerable hydropower resources are concentrated in the river basins of the Yakut ASSR, the potential of which is estimated to be 500 billion kWh.

The existing design studies show that the expected development of the economy and solution of social problems will lead to an increase of electricity consumption by about 2 times by 2000 and by 3.5-4 times by 2010. During the three years of the current Five-Year Plan, the rate of increase of electricity consumption of the Eastern interconnected power system (IPS) was 6.6% versus the country's average 3.3%, and to overcome the economic lag of the Far East, the region should develop at a faster rate.

In the structure of electricity consumption, industry and construction account for 40%, transport for 10%, public and household needs of the population for 20%, and miscellaneous for 30%.

This structure will not undergo substantial changes in the future.

The regime of electricity consumption is characterized by a high density of the daily and weekly load curve and by a rather thinned annual curve.

Thermal power stations predominate in the structure of the generating facilities of the Eastern IPS, accounting for 79% of the installed capacity and 84% of electric power production of the system.

Hydropower in the Eastern IPS is represented for now by a single hydroelectric station performing all regime functions in the system, the Zeya hydrostation; the Bureya and Lower Bureya are under construction. The complex of Vilyui hydrostations operates in the Yakut ASSR.

An analysis of the daily load curves of the Eastern IPS shows that the existing hydrostations and those under construction reduce a considerable part of the nonuniformity, and new energy sources should be aimed mainly at the half-peak and base-load operating regimes. This determines the rather high requirements imposed on the annual number of hours of use of the installed capacity of new energy sources in the IPS; the balance of energy of the IPS is reduced when the annual number of hours of use of the capacity of the future power stations is about 5000 h/yr.

The development of the energy base of the Eastern IPS was planned mainly due to nuclear power stations, the Kom-so mol'sk (Far Eastern) and Primorskii nuclear power stations and hydrostations in the Amur basin. With consideration of the existing difficulties in realizing the program of construction of nuclear power stations and selection of their sites, the time of constructing the nuclear power stations has presently been put off to the more distant future. State regional power stations (SRPSs) operating on fossil fuels are being considered among the main sources of base-load facilities both in the northern and southern regions of the Eastern IPS. The problem of fueling these SRPSs has not been solved. More than 1000 coal deposits and occurrences have been found, but they are insufficiently explored and studied. The situation with fuel resources is especially strained in the southern regions of the Eastern IPS.

Despite the great potential reserves of such deposits as the Ural'sk, Ogodzha, Svobodno, Tygda, the attained provision of shafts and sections with demonstrated reserves is far from sufficient. A considerable part of the areas of these deposits has low technical and economic indices, unfavorable location relative to consumers, and poor quality of the coals. All this hampers their use at operating, abuilding, and planned power stations and boiler houses and requires considerable expenditures on restructuring the fuel handling facilities and equipment.

The use of hydropower resources can become an essential direction in the energy balance of the investigated IPS.

Variants of a considerable increase of the deliver to this region of coals of the Kansk-Achinsk coal basin and in the more distant future coals of the Kangala deposit (Yakutsk ASSR) are being considered. However, the reality of such delivery is unlikely, considering that about 25 million tons of coal will be needed for power by 2000 and 50 million tons by 2010. Recently the idea of the temporary development of the energy base of the Far East with the use of gas of reservoirs discovered and being explored on the shelf in the Sakhalin region, the so-called gas intermission, is gaining popularity. Plans of constructing ice-stable platforms each with a production volume of 5-8 billion m$^3$, its delivery to the continent in the USSR, and export of a considerable part of it to neighboring countries (including for compensation payment for delivery of the ice-stable platforms) are being considered.

Considering the considerable difficulties of such a solution, the technical, financial, and other considerable possibilities, and high economic hard-currency effectiveness of exporting gas, in our opinion its burning at thermal power stations, given an unlikely, considering that about 25 million tons of coal will be needed for power by 2000 and 50 million tons by 2010. Recently more distant future coals of the Kangala deposit (Yakutsk ASSR) are being considered. However, the reality of such delivery is not very well-founded. Such an alternative can be the wider use of the energy of Far Eastern rivers, particularly in Yakutia.

In the Yakut ASSR the hydropower resources of the Vilyui River are being developed, hydropower stations are being planned on the Adycha and Olenek rivers, but all these facilities are local, whereas in the republic there are possibilities of constructing large hydropower facilities of regional significance which could yield the republic considerable profits under self-supporting conditions. Of greatest interest in order of possible priority are a number of hydropower stations in the Aldan River basin in southern Yakutia with a total generation of electricity of the most prospective hydrostations of about 40 billion kWh. The construction of a Bering—Tommot—Yakutsk railroad will create transport conditions for construction of the hydropower stations in that previously difficultly accessible region. The construction in southern Yakutia of the Neryungri SRPS and power connections with the Far East IPS create the energy base for launching the construction of hydropower stations and the formation of a power intertie with the Far East IPS.

The comparatively low level of use of water resources by industry, public sector, agriculture, fisheries, and water transport (with the exception of the Lena River) enable hydropower to become in this region the sector determining the direction of use of water resources.

An analysis of technical and economic indices and construction conditions of hydropower stations by the All-Union, Planning, Surveying, and Scientific-Research Institute (Gidroproekt) in the "Scheme of Disposition of Hydropower stations in the Yakutsk SSR" showed that the construction of large hydropower stations in the Yakutsk ASSR should begin with cascades of hydropower stations on tributaries of the Aldan River — on the Uchur and Timpton rivers.

Hydropower stations on these rivers are unique in energy parameters and management and ecological conditions. The rivers are not used for shipping and fisheries, there are no populated areas, farmlands, and mineral deposits, and the growing stocks of trees are small in the reservoir zones of the future hydropower stations. The effect of reservoirs on the established nature management complex will be minimum.

Studies showed that the use of the energy potential of the Timpton and Uchur rivers is advisable in the form of two-step cascades with the creation of upper main regulating reservoirs with high dams and low-head counterregulators. With consideration of the characteristics of the regions of siting the hydropower stations, the principal purpose of the counterregulators is to reduce the effect of the main hydro developments on nature, in particular, to shorten the length of the nonfreezing polynya in the lower pools of the main hydro developments.

The cascade on the Uchur River consists of two hydro developments — the Middle Uchur with a carryover reservoir and the Uchur counterregulator; the cascade on the Timpton River consists of the Idzhek and Lower Timpton counterregulator. A brief description of the hydro developments is given below.

The region of the site of the Middle Uchur hydropower station is 180 km from the river mouth. The river valley at that place is composed of strong metamorphic rocks, gneisses and schists, covered with a layer of alluvial deposits 3-10 m thick. The seismicity of the region is intensity 7. The maximum flood discharge of 0.01% probability is 64,700 m$^3$/sec.

The hydro development is composed of a high dam, powerhouse complex, and combined diversion-service spillway.

The maximum height of the dam is 200 m, crest length 1600 m. The problem of selecting the dam material is one of the most important, technically complex, and determining the time of constructing the hydro development. This is due to the geological characteristics — absence in the Uchur River valley of cohesive soils and extremely limited supplies of sand and gravel, and the difficulty of delivering imported materials. These circumstances served as grounds for deciding, at the given stage of the works, to use a rockfill dam with an asphaltic concrete (or simply concrete) core wall. But this variant has certain minuses: the need to construct three large-diameter (20 m) tunnel conduits with a length of 1325 m for passage of a flood with a discharge of