BIOPOLITICS PROBLEMS OF LARGE-SCALE HYDRAULIC ENGINEERING CONSTRUCTION

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The twentieth century, which will enter in history as the century of large-scale hydraulic engineering construction, has come to an end. Only on the European continent, 517 large reservoirs - more than 1,000 mln/m^3 - in which more than 620 km^3 of water per year were detained, had been constructed from 1901 to 1985.[1] In the Danube basin, a plethora of reservoirs, power stations, navigating sluices and other hydraulic engineering structures have been constructed, and more than 40 particularly large structures are located along the main bed of the river. A number of hydro-complexes, such as the Dnieper-Danube Complex, the Gabcikovo Complex, the Danube-Oder-Laba Project, the Danube-Tissa Complex, the Danube-Adriatic Sea Project, the Danube-Aegean Sea Complex and the Danube-Black Sea Complex, have already entered into operation or are in the stage of being designed.

Heavy hydraulic engineering construction was especially conducted in Ukraine. On its territory, some large reservoirs on the Dnieper and the Yuzhny Bug were constructed, which have radically changed the hydrological regime of these rivers. Summarising the results of river system regulation in Ukraine, one can note that, in total, more than 27 thousand ponds - 3 km^3 per year - 1,087 reservoirs of a total volume of 55 km^3, and 11 large channels of a total length of more than 2,000 km and with a productivity of 1,000 m^3/s have been created.[2]

Hydraulic engineering construction played an important role in the development of industry and agriculture, urban and rural water-supply, and the maintenance of safe navigation in the Danube, Dnieper and other rivers. At the same time, the transformation of some waterways has resulted in deep and irreversible changes in extensive territories of a number of countries. For example, construction of the Karakum Channel in Central Asia altered the largest part of the freshwater runoff, which earlier came to the Aral Sea. This has resulted in the actual destruction of the sea. The water level in the sea has fallen by 14 m, therefore over two million hectares of the marine bottom have been transformed into sandy and saline desert. Many species, not only marine but, also, land flora and fauna have disappeared. Today, the Aral Sea area is considered to be a zone of ecological disaster. The people leave this region, and natural and cultural monuments have been destroyed.[3] During the span of one generation the whole sea disappeared. Only its name is still indicated on maps.

Other hydraulic engineering projects could also have unfavourable consequences, should they be realised, but they were terminated in due time. Construction, in Russia, of the "project of a century," involving the deviation of northern and Siberian rivers - Severnaya Dvina, Onega, Pechora - from the White Sea to the opposite direction, the Caspian Sea, was suspended. Should it be realised, huge territories of unique northern landscape will be submerged. Many historical monuments of northern and ancient Russia, the Kiril-Belozersk Monastery, and other monuments of northern culture, will also be submerged.[3]

Hard efforts and strong political courage were required in order to stop constructing the Danube-Dnieper water economic complex (WEC) and the sea-blocking dam in the Dnieper-Bug lagoon, which had already begun in Ukraine.

The Danube-Dnieper WEC is an ecologically complex system aimed at rearranging a part of the Danube water runoff. Besides the Danube-Dnieper channel, it involved other elements on the basis of which freshwater reservoirs and artificial watercourses were designed.[4,5] These were: the Kilia delta, the mouth areas of the Dniester, the Dnieper and Yuzhny Bug rivers, and the Black Sea coastal salt lagoons of Sasyk, Dnestrovsky, Khadzhibeyevsky, and Tiligulôsky. As an independent object, but subsequently connected with the Danube-Dnieper WEC, the Dnieper-Bug hydro-complex was designed, including a sea-blocking dam near Ochakov, a sluice for marine vessels to pass through and other structures. During construction, the Sasyk lagoon was separated from the sea and connected by an 11 km channel with the Kilia delta of the Danube. Preliminary works on the Dnieper-Bug lagoon had been conducted. The ecosystem of the Dnieper-Bug mouth area is estuarine, a characteristic attribute of which is the availability of a free connection with the sea and constant influence of river runoff. Thus, river runoff is adjusted by the operating regime of the Kahovka hydraulic engineering unit.[6]

Construction of the sea-blocking dam is aimed at the withdrawal of water from the Dnieper and at the prevention of the penetration of salt and marine water, in the case of infringement on the balance between freshwater runoff and Black Sea water pressure. Complex research has shown that separation from the sea and decrease of river runoff would inevitably result in: reduction of more than 10 times in the water exchange rate in the water body formed; deterioration of water quality due to the release of biogenic and toxic substances from the bottom deposits and outside; sharp decline of self-purification processes in the water; and, strengthening of biological self-pollution as a result of eutrophica-tion. The unique estuarine ecosystems included in the Chernomorsky biosphere reserve, would lose their biological significance as

a result of water-logging of floodplain water bodies and other degradation processes.[7] A comprehensive ecological/economic examination proved that the project was ecologically unsound and economically inexpedient and so construction was terminated.

Realisation of the Danube-Dnieper WEC would have even more catastrophic consequences. The technical and water object transformation solutions of the complex have no analogues in world hydraulic engineering practice.[8] The first turn of the Danube-Sasyk channel and the separation of the lagoon from the sea were completed in 1987. However, use of the water from the formed reservoir for irrigation purposes, due to increased water mineralisation, resulted in salting of the arable layer and a sharp worsening of physical properties of the soil. Dense crust was formed on the salted soil surface, which could not be processed. It has become clear that desalination in areas contiguous to the Black Sea is a more complex problem than it seemed to the project elaborators.

This was only one argument for the benefit of suspension of construction. However, a comprehensive analysis of such global interference in water ecosystems has shown, that in the case of project realisation, the unique estuarine ecosystems of the mountain rivers would be lost, biota deterioration in the shelf zone of the Black Sea would be sharply increased, and flooding phenomena followed by removal from agricultural turn-over would be advanced.

This paper gave a few examples of the ecological miscalculations of large-scale hydraulic engineering construction. Before the beginning of the 21st century, error analysis is as important as a chronicle of achievements. The proj-ects considered are terminated. In view of years of struggle against departmental interests and inspirers of such insane nature transformation, one must have faith in the following century, in which the errors of the past should not be repeated.

References

1. Nauka M. (1986) Reservoirs and their effect to the environment. 365 pp.
2. Romanenko V.D. (ed.) (1987) Nature of Ukrainian SSR. Seas and inland water bodies. Naukova Dumka, Kiev, 224 pp.
3. Yanshin A.L. and Melua A.I. (1991) Lessons from ecological miscalculations. 430 pp.
4. Ponomarenko V.D. (1980) Danube-Dnieper channel. Hydraulic Eng. Melior. 11:81-83
5. Ponomarenko V.D., Stolenberg F.V., Oksiyuk O.P. et al. (1981) Water protection complex of the Danube-Dnieper channel. Hydraulic Eng. Melior. 12:80-84
6. Zhukinsky V.N., Zhuravleva L.A., Ivanov, A.I. et al. (1989) Ecosystem of Dnieper-Bug estuary. Naukova Dumka, Kiev, 240 pp.
7. Romanenko V.D., Oksiyuk O.P., Zhukinskiy V.N., Stolenberg, F.V. and Lavrik, V.I. (1990) An ecological assessment of the effect of hydraulic engineering construction to the aquatic objects. Naukova Dumka, Kiev, 256 pp.
8. Romanenko V.D., Oksiyuk O.P., Zhukinskiy V.N. et al. (1984) Ecological problems of the transbasin water relocation. Naukova Dumka, Kiev, 256 pp.

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