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CENTRAL INTELLIGENCE AGENCY REPORT

INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS CD NO.

50X1-HUM

COUNTRY USSR

DATE OF INFORMATION 1949

SUBJECT Economic - Power plants and irrigation

DATE DIST. 18 Oct 1949

HOW PUBLISHED Bimonthly periodical

WHERE PUBLISHED Moscow

NO. OF PAGES 4

DATE PUBLISHED May/Jun 1949

SUPPLEMENT TO REPORT NO.

LANGUAGE Russian

THIS IS UNEVALUATED INFORMATION

SOURCE Geografiya v Shkole, No 3, 1949.

TRANSFORMATION OF A SOVIET RIVER SYSTEM

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When forest belts have been planted to the edges of the deserts around the Caspian Sea, the next task will be to transform the deserts into productive land. In the accomplishment of this task, it is necessary to consider the water potentialities of three basins, those of the Volga River, Aral Sea, and the Ob and Yenisey Rivers.

The Volga basin will not be able to contribute to the task stated above. Agriculture upstream makes heavy demands on its water resources. To irrigate the dry Caspian Lowland, comprising 44 million hectares, would require not less than 240 cubic kilometers of water per year. To irrigate this area, even by using water from the Ural, Kura, and Terek Rivers, might require 180 cubic kilometers from the Volga. When it is considered that the flow of the Volga equals 255 cubic kilometers per year and supplies 80 percent of the water added to the Caspian Sea, it is evident that a withdrawal of 180 cubic kilometers is out of the question.

Calculations have indicated that diverting water from the northern rivers (Pechora, Vychegda, Onega) and from the Sea of Azov to bolster the falling level of the Caspian Sea would add not more than 25 - 40 cubic kilometers per year.

The idea of reducing the area of the Caspian Sea by cutting off its bays with the goal of reducing evaporation losses in inadmissible because studies have shown that the flow of Central Asian and Kazakhstan rivers is closely connected with circulating air masses saturated with moisture evaporated from the surface of the Caspian Sea. Therefore, a measure which would reduce the 75 - 100 cubic kilometers of water which the Caspian Sea now receives from these rivers in its basin, must be opposed.

The flow of water from the Amu-Dar'ya and Syr-Dar'ya Rivers into the Aral Sea amounts to 56 cubic kilometers per year. This inflow maintains the present water level of the Aral Sea.

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Central Asia is important to the Soviet Union as a cotton-growing region. There are more than 100 million hectares of land suitable for crop growing, for which the climate is outstandingly favorable. Potentials for grain production and cattle raising are enormous. In addition, Central Asia has oil, iron ore, nonferrous metal and rare metal ores, and chemical resources. The main obstacle to making extensive use of the riches of Central Asia and Kazakhstan is the lack of water.

The 36 cubic kilometers of water which flow from the Amu-Dar'ya and Syr-Dar'ya rivers into the Aral Sea will be used in the next Five-Year Plan for irrigating about 4 million hectares of land. Adding the land under irrigation at present, the total amounts to about 8 percent of land suitable for irrigation.

The water requirements of the Turana Lowland (Turanskaya Nizmennost') for irrigating 25 million hectares of land (including 6 - 7 million hectares in cotton) and 20 million hectares of desert are estimated at about 250 cubic kilometers per year. To stabilize the water supply in the Caspian Sea and to hold it at the required level requires about 75 - 100 cubic kilometers of water per year. Thus, the total amount of water needed for the Turana Lowland is estimated at 300 - 350 cubic kilometers per year.

Where and how can this water be obtained? The water resources of the Caspian Sea basin must be used in European USSR, in Azerbaydzhan, and in the northern Caucasus.

The Ob, Yenisey, Lena, and other rivers of the northeastern USSR have an abundance of water, which drains into the Kara Sea. The Ob and Yenisey annually discharge an average of 942 cubic kilometers of water into the sea. The indicated annual water requirement for irrigation within the limits of their basins amounts to only 32 cubic kilometers for irrigating 10 - 12 million hectares of steppe in West Siberia.

So, the thought arises whether a part of the Siberian water could be diverted to the Aral-Caspian basin where it could be used to maximum advantage. The diversion would be accomplished by the construction of dams and a system of connecting canals.

On the Ob, below the inflow of the Irtysh and near the village of Belogor'ye a 78-meter-high dam, impounding water to a height of 75 meters above sea level, could be built. It would create a 250,000-square-kilometer reservoir capable of holding 4,460 cubic kilometers of water. At Belogor'ye, the flow of the Ob amounts to about 10,000 cubic meters per second or 327 cubic kilometers per year.

Along with the dam, a hydroelectric power station would be built at Belogor'ye. With a capacity of 5,600,000 kilowatts and annual generation of 34 billion kilowatt hours of power, it would be an all-sufficient source of power for the industrial Urals, 500 - 600 kilometers distant.

The Ob reservoir would spread out upstream along the Ob, Irtysh, and Tobol rivers and reach the northern slope of the Aral - Irtysh water divide (the Turgay Gateway). From the city of Kurgan along the valleys of the Tobol and Ubogan (Tobol tributary) rivers, the water divide would be breached by a canal cut to an average depth of 40 meters and to a maximum depth of 75 meters. The canal would be 930 kilometers long from its northern extremity to its southern terminus at Chelkar-Tengis Lake and could carry a flow of water 20 meters deep.

At the point of outflow from the canal on the southern slope of the water divide, a 10-meter drop would result at Turgay where a one-million-kilowatt hydroelectric plant could be built. This plant could generate 6.5 billion kilowatt hours of power annually. A part of the water from the Turgay GES would be used for irrigation of the steppe areas extending in the directions of the Aral Sea, Irgiz, Turgay, and Kazalinsk; the remainder would flow towards the Aral Sea.

The level of the Aral Sea would rise from 53 to 54 meters. The sea would be transformed into a flowing reservoir for accumulating 150 cubic kilometers of winter-flow water.

During the growing season, the water from the Aral reservoir would be applied to irrigating about 2 million hectares of land along the shores of the sea. By getting the winter flow of water, the reservoir would offer a potential 300 cubic kilometers of water for irrigation purposes during the growing season, a quantity which would assure irrigation of vast areas of the Kyzyl-Kum Desert. By means of a connecting canal, the water from the Aral Sea would enter the Sary-Kamysh Depression and rise to a height of 51 meters. The Sary-Kamysh reservoir would cover more than 10,000 square kilometers.

While the Sary-Kamysh Depression would be filling with water, the larger Assake-Kaudan Depression located nearby would also be filling up. The Assake-Kaudan water could be used for irrigating the Ust'-Urt Plateau, although the most effective use to be made of this water would be decided upon after more detailed study of national economic requirements. The Sary-Kamysh reservoir would assure irrigation water for about 4 million hectares. Any excess water would enter the dry bed of the Uzboy and eventually reach the Caspian Sea.

Three dams on the Uzboy would create a 3-million-kilowatt hydroelectric power plant cascade generating 18 billion kilowatt-hours of power annually.

The Uzboy reservoirs would assure enough water for irrigating about 8 million hectares for growing cotton and other crops.

The over-all length of this contemplated waterway, from the Belogor'ye dam to the Caspian Sea, would be 4,000 kilometers. Lakes, seas, and reservoirs (Ob reservoir, Chelkar-Tengis Lake, Aral Sea, and Sary-Kamysh reservoir) would account for 1,800 kilometers of this distance, dry beds of old rivers for 950 kilometers, and connecting canals for the other 1,250 kilometers. The hydrotechnical work of the whole project could be carried out in successive stages since each stage would result in a complete installation which would justify itself economically.

To supplement the water diverted from the Ob reservoir to the southern slope of the water divide and to maintain the installed capacity of the Belogor'ye GES, it would be necessary to use part of the flow of the Yenisey River. An 80-meter-high dam could be built below the mouth of the Podkamennaya Tunguska River at the Osinovskiye Rapids, where the average annual discharge of water amounts to 10,800 cubic meters per second. The dam would form a huge reservoir which would spread out upstream, reach a left tributary of the Yenisey, the Bolshoy Kas River, and proceed from the east towards the water divide between the Ob and Yenisey, the highest elevation of which is 112.5 meters. From the Bolshoy Kas, a canal would cut through the water divide and the water would flow into the Ket' River, a tributary of the Ob. Where the canal ends on the western slope of the water divide and joins with the Ket', a 35-meter drop would be created which could be utilized for building a 2,500,000-kilowatt GES producing 18 billion kilowatt-hours of power annually.

A GES and lock would be built in connection with the dam on the Yenisey. The 740,000-kilowatt GES would produce 4.7 billion kilowatt hours of power per year and would operate on the 1,000 - 1,500 cubic meters per second of water permitted to flow through the lock for the needs of navigation.

The waterway between the Ob and Yenisey built in 1896 for the passage of small boats along the Bolshoy Kas and Ket' Rivers would be rebuilt for passage of large boats from the Ob Reservoir to the Yenisey.

These proposed hydroelectric and water economy projects are grandiose in scope and amount of work required but are fully attainable with modern construction techniques.

The volume of earthwork required in building the Ob-Aral-Caspian and Ob-Yenisey connecting canals would total 23 billion cubic meters of earth.

Construction of the Ob-Aral-Caspian water connection would help to effect the following:

1. Create a 34-billion-kilowatt-hour-per-year electric power source (Belogor'ye GES) for the Urals, resulting in a saving of 30 million tons of high-grade coal.

2. Create a 24-billion-kilowatt-hour-per-year electric power source (Turgay GES and Uzboy GES) in Central Asia, Kazakhstan, and the southern Urals.

3. Create a 25-million-hectare area suitable for cotton, grain, and livestock production in the Turan Lowland and reclaim for irrigation and afforestation a 20-million-hectare desert area adjoining the waterway.

4. Remove the obstacles which block the utilization of the water of the Volga and other rivers flowing into the Caspian and Aral seas for irrigation, electric power, and water transport.

5. Reduce the dry winds in the Turan Lowland and their negative influence on climatic conditions in the Volga, Don, and southeastern areas of the country; increase the significance of the shelter belts to be planted up to the borders of the Caspian desert.

6. Maintain the level of the Caspian Sea at a fixed level of 25 - 26 meters; alter the hydrological role of the rivers of Central Asia, Kazakhstan, the Urals, and Siberia; alter the climate of the Turan Lowland and adjacent areas through the evaporation of 300 - 350 cubic kilometers of water per year, diverted from the Siberian rivers.

7. Create a waterway connecting the Kara Sea, the Caspian Sea, and Lake Baykal.

The industrial Urals would be connected by water with the Kuzbass, Central Asia, and the Caspian Sea; the forests of Siberia would be joined with the forestless regions of Central Asia and Kazakhstan. The waterway would allow passage of 600 million cubic meters of wood per navigation season.

8. Create powerful hydroelectric power stations - Yenisey GES, Kot' GES, Belogor'ye GES, Turgay GES, and Uzboy GES - which could become the basis for forming a single high-voltage system for the USSR, connecting the European and Asiatic parts of the country.

9. Affect drought conditions in the steppes and forest steppes of West Siberia and Kazakhstan, since the Ob reservoir would influence the climate of West Siberia. Forest belts could be planted east of the Urals, gradually covering new expanses of land between the Urals and Emba and further into the Ust'-Urt Plateau and the Turan Lowland.

The reclamation of desert for agricultural and forest purposes, the output of about 80 billion kilowatt hours of electric power, the processing of mineral resources, all these would require the resettlement of more than 50,000,000 people.

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