The Problem of Transferring Part of the Flow of Northern Rivers of Russia to the Southern Regions

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Abstract: The transfer of the Siberian rivers for water supply to Kazakhstan and Central Asia is one of the most ambitious of the failed engineering and construction projects of the twentieth century. Not surprisingly, the project was not implemented due to the enormous volume construction of system of canals and reservoirs, huge financial and material costs and the catastrophic environmental consequences of the project. However, the problem of shortage of drinking water in the southern regions is escalating every year and needs to be addressed. One such solution could be transporting excessive part of the flow of Northern rivers to the South for large diameter pipes, which requires serious feasibility study.

1. Introduction

Draft transfer of part of the flow of Northern rivers to Kazakhstan and Central Asia was developed by the Ministry of land reclamation and water management of the USSR and provided the direction of the flow of Northern rivers (Pechora, Irtysh, Ob and others) in the southern regions of the country that desperately need fresh water. Ambitious project involved the construction of a system of canals and reservoirs to transport water in Kurgan, Chelyabinsk and Omsk region of Russia for irrigation and water supply, recovery of the Aral sea and the rising level of the Caspian sea. In addition, provided fresh water supply in Kazakhstan, Uzbekistan and Turkmenistan with the purpose of irrigation. As the main object is designed channel Siberia — Central Asia from the Ob river through Kazakhstan to the South in Uzbekistan. The canal was to be navigable with a length of 2550 km, width 130-300 m, depth 15 m and a flow rate of 1,150 m^3/s.

The preliminary cost of the project is clearly lower data of the Ministry amounted to 32.8 billion rubles, in that time, by the most approximate calculations of experts, the construction of the canal could not do less than 100 billion rubles. Against the implementation of the project sharply criticized the scientific and creative society: there have been numerous publications in the press, and the authors justified the failure of this project in the first place, from an environmental point of view [12]. Academy of Sciences of the USSR prepared a negative expert opinion, which revealed major errors in the design of objects to the transfer and prediction of its consequences. Given the reaction of society, and most importantly – the growing economic crisis in the USSR and the inability to finance the project, in 1986, it was decided to terminate its development.

2. Discussion

However, the problem of shortage of drinking water in the southern regions not only stabilized, but is extremely deteriorated in recent years. According to the World Health Organization more than two billion people suffers from shortage of drinking water, and by 2020 their quantity will increase twice. Fresh water has become extremely scarce and, moreover, an expensive natural resource, almost equaling the price of oil, and in some countries (the United Arab Emirates, Iraq) exceeding it. The lack of water gives rise to a whole range of economic, social and political problems that could undermine world stability and lead to major regional conflicts.

Understanding the critical importance of problems and opportunities for major political and economic dividends resulted in the recent return to the idea of turning the Northern rivers to the South made, in particular, in the book the former mayor of Moscow Yuri Luzhkov, "Water and peace" [6]. Unfortunately, the misunderstanding by the author of the whole complex of problems associated with the implementation of this idea led to simple resuscitation rightly convicted earlier project of the Ministry of land reclamation and water management of the USSR and cause the negative reaction of experts and the scientific community [4,5,7,8,10,11]. However, the need to revisit the question of the transfer of part of the flow of Northern rivers to Central Asia was made by the Presidents of Uzbekistan Islam Karimov and Kazakhstan N. Nazarbayev.

However, if the concern of the authorities of Uzbekistan is quite clear in the absence of reliable water sources, the presence in Kazakhstan of the channel Irtysh – Karaganda and some of the reservoirs on the Irtysh (Bukhtarma, Ust-Kamenogorsk), and its tributaries Ishim, Tobol, which selects up to 60% of annual river flow [2], which requires, obviously, new approaches to the redistribution of water resources in the country.

Of course, an important role in reducing the shortage of fresh water could play water management: reducing water use in agriculture, the use of water-saving technologies in industry, saving water consumption by the population. Significant progress in the development of water-saving technologies achieved in the developed countries of Europe, where there are agreements about the use of water and energy resources in river basins for the transition to a model of effective technological system of water use economic mechanism of interstate regulation of water resources, carrying out activities in the field of protection of the environment and water bodies [3,9].

Such agreements on a mutually advantageous basis can allow Russia and the Central Asian countries to develop a mechanism for adequate distribution of water resources and, if necessary, to find alternative sources of water supply. The maximum water use for irrigation, should ensure the reduction of irrigated area and introduction of drip irrigation. It is necessary to minimize irrigation network in the form of open channels, especially without impervious protection (too often not effective enough) and ensure the flow of water through the pipes. This becomes especially relevant, considering the catastrophic drought in Russia in 2010, assessing the consequences of which Russian President Dmitry Medvedev stated about the need to restore the destroyed system of land reclamation in our country. They also discussed the possibility to return to the discussion of various solutions to the problem of drought and ensure drinking water to the entire Central Asian region.

One of these options, in our opinion, could be the transportation of a minor part of the flow of Northern rivers to the South for large diameter pipes by creating water mains. The water became almost as valuable a commodity as oil, and no one doubts the necessity of building a large and very long pipelines, the cost of construction of which pay off quickly. It is necessary to take into account the fact that water, unlike oil, is a renewable natural resource. Transportation of water in pipelines will eliminate such major environmental problems arising from the construction of the channels as:

flooding by reservoirs, agricultural lands and forest lands;

loss of water through seepage and evaporation from canals;

the rise of groundwater level, waterlogging and salinization of adjacent areas;

disruption of traditional migration routes of animals and their habitats.

North of Russia is one of the richest natural water resources regions of the world. The annual runoff of the major river basins of the Northern rivers are shown in table 1 [1].

Table 1. The annual runoff of river basins.

Rivers	Catchment area, km^2	Confluence	Long-term average annual flow at the mouth (km^3)
Northern Dvina	357	White Sea	109
Vychegda	121	Northern Dvina	36,6
Pechora	322	Barents Sea	130
Ob	2990	Ob Gulf	400
Chulym	134	Ob	24,8
Irtysh	1643	Ob	89,3
Ishim	177	Irtysh	2,16
Enisey	2580	Kara Sea	630
Taz	150	Kara Sea	45,7

It should be noted that river flow in many basins of these rivers to a large extent regulated through the creation of reservoirs. General characteristics of reservoirs on the main river basins is given in table 2 [1].

Table 2. Indicators flow regulation in river basins.

River basin	Number of reservoirs	Surface area (thou.km^2)	Full volume, km^3	Useful volume, km^3
Northern Dvina	5	0,66	1,76	1,42
Pechora	4	0,01	0,06	0,02
Ob	268	2,45	13,99	8,48
Irtysh	173	1,1	3,88	2,9
Enisey	53	12,37	358,85	114,67

We should pay attention to the extremely low use of water for drinking, industrial, agricultural and other needs. As an example, consider the characteristics of water resources and indicators of their use in the Ob-Irtysh basin (table 3).

Table 3. Water resources and their use in the Ob-Irtysh basin [2].

The subjects of the Russian Federation	The mean annual inflow (km^3)	Runoff within the territory (km^3)	Runoff outside the territory (km^3)	Used water, km^3
1	2	3	4	5
Altai Republic	0,94	48,9	49,8	0,663
Novosibirsk oblast	51	8,1	59,1	0,837
Kemerovo oblast	2,9	37,4	40,3	2,057
Tomsk oblast	113	72,2	185	0,143
Tyumen oblast	249	141	390	1,376
Omsk oblast	32,5	6,3	38,8	0,382
Kurgan oblast	2,45	1	3,45	0,117
Sverdlovsk oblast	_	22	22	1,332
Chelyabinsk oblast	_	2,2	2,2	0,603
Total	-	390	390	7,510

The data show the possible future use of a minor part of surface runoff of the Northern rivers to water supply of the arid southern regions. This, of course, about any "turning the rivers" and the construction of a giant channels cannot be considered. Similar projects had shown its complete failure and should not be revived. At the same time, a huge experience of Russian specialists in the construction of major trunk pipelines may be used to supply water from North to South with secured profitability and environmental safety.

3. Conclusions

Carry out simple feasibility calculations. For example, the flow of the Pechora river is 127 km^3/year, used for household needs of 500 million m^3/year, i.e. less than 0.5% of the annual runoff, but existing loss of water during transportation is about 100 million m^3/year [2]. In the case of construction of a water main with a diameter of 1220 mm even at a minimum water flow in the pipe of 1000 l/s to about 32 million m^3 or 200 million barrels of fresh water per year. In this case, the selection of water would amount to only 0.03% of the annual flow of the river. If as an example the Ob river, the annual consumption of which is 400 km^3/year, the construction of one leg of the aqueduct will lead to the selection of less than 0.01 % of its annual flow and, of course, will not have a significant environmental impact. At the same time when bringing the water to potable standards at a price its about $50 per barrel, the value supplied on the same water pipeline may reach $10 billion a year. It is not excluded that such a project could be of interest to a number of countries in Central Asia and the Middle East, rich in oil, but with an acute shortage of water resources.

However, the problem of shortage of drinking water in the southern regions not only stabilized, but is extremely deteriorated in recent years. According to the World Health Organization more than two billion people suffers from shortage of drinking water, and by 2020 their quantity will increase twice. Fresh water has become extremely scarce and, moreover, an expensive natural resource, almost equaling the price of oil, and in some countries (the United Arab Emirates, Iraq) exceeding it. The lack of water gives rise to a whole range of economic, social and political problems that could undermine world stability and lead to major regional conflicts.

Of course, it is necessary to properly assess the economic and environmental risks at the possible implementation of such a project, which should perform a careful feasibility study.

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