IN THE EXAMPLE OF REDUCING OPERATING COSTS AT PUMPING STATIONS

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Abstract. *This article, using the example of the work of the large enterprise "Alamaidan", examines the main stages of the production process of a water treatment plant, as well as problems in the operation of pumping equipment. The authors proposed energy-saving measures for non-stationary processes that make it possible to achieve energy savings when operating the enterprise's technological equipment.*

Keywords: *energy saving, pumping unit, unit, mode, program, supply, energy consumption, resource, concept.*

INTRODUCTION

In Uzbekistan, the "green" economy is gaining momentum, allowing the state to develop along a fundamentally new path. According to the adopted Concept, state policy puts forward priority and key tasks aimed at energy and resource conservation, and a significant reduction in environmental impact.

MATERIALS AND METHODS

The main consumers of energy (more than 90%) in the water supply and sewerage systems of settlements and industrial facilities of the city are pumping systems for natural, drinking, industrial and waste water, for supplying reagents and air.

The water treatment facilities of one of the divisions of a city enterprise include two stations (blocks) connected to each other by water pipelines and RFB and can operate either autonomously or both stations simultaneously, depending on the season of the year and the required analysis by consumers.

RESULTS AND DISCUSSION

To supply river water at the water treatment facilities, there are two first lift pumping stations: one pumping station with a capacity of 20 thousand m³/day is the main one and operates around the clock throughout the year (block No. 1) and a second pumping station with a capacity of 9 thousand m³/day operates in spring and summer (block No. 2). The rest of the year the station is in reserve.

Water from a source of 20 thousand m³/day (block No. 1) is taken from one channel-type head with one-way water intake, built according to standard design 901-1-5, the productivity of which ranges from 20 to 1000 l/sec. Then, through two gravity pipelines DN 700 mm, water flows into two receiving chambers, which are located in a recessed pumping station of the 1st lift. Next, the first lift pumps supply water through two water pipelines DN 400 mm through the stages of cleaning to the main structures. 3 pumps of the 1D630/90 brand were installed, with a capacity of 500 m³/hour each.

Water from a source of 9 thousand m³/day (block No. 2) is taken by a water receiver of the ROP type and through two gravity pipes DN 300 mm enters two recessed receiving chambers, from where the water is supplied by first lift pumps through two water pipelines DN 250 mm according to the stages of purification station (block No. 2). At the 1st rise of block No. 2 there are 2 pumps of the brand: 8HDB and a pump of the 200D-60 brand.

To avoid silting of the gravity pipes of the water intake, flushing from the pressure pipeline of the 1st lift pumping station with a reverse flow is provided.
Both first lift pumping stations, the characteristics of the technical equipment of which are presented in Table 1, are looped together.

The pumps operate according to an approved schedule depending on the season of the year.

To supply purified drinking water to the city network to the consumer, the station has two second lift pumping stations (Table 2): one main, with a capacity of 20 thousand m³/day (block No. 1) and a second reserve, operating in the spring and summer periods as needed as an auxiliary one, with a capacity of 9 thousand m³/day (block No. 2).

Table 1

Technical characteristics of pumping equipment of the 1st lift pumping station

Name	*Block No. 1*			*Block No. 2*		
	Pump brand	*Number of pumps n, pcs.*	*Pump supply Q, m3/hour*	*Pump brand*	*Number of pumps n, pcs.*	*Pump supply Q, m3/hour*
Pumping station 1st lift	1D630/90	1	500	8HDB	1	600
	1D630/90	1	500	200D60	1	500
	1D630/90	1	500	BBH-3	1	28

Table 2

Technical characteristics of pumping equipment of the 2nd lift pumping station

Name	*Block No. 1*				*Block No. 2*			
	Pump brand	*Number of pumps n, pcs.*	*Pump supply Q, m3/hour*	*Head N, m*	*Pump brand*	*Number of pumps n, pcs.*	*Pump supply Q, m3/hour*	*Head N, m*
Pumping station 2nd lift	300D70	2	1080	56	200D60	1	480	67
	D800-57	1	800	57	D320-50	1	320	50
	16HDN	2	1500	15	10D6	1	580	65
					12D19	2	500–900	14,2–21
					BBH-12	2	28	

At the main station in the machine room, three pumps are installed: two 300D-70 pumps and one D-800-57 pump, in addition, two 16HDN washing pumps are installed for washing filters. In case of an emergency or in case of a reduced RF level on the second rise of the main unit, the network pumps are connected to the vacuum system with a BBH-12 pump.

At the second lift of the reserve station (block No. 2), 4 working pumps and two vacuum pumps are installed, since the pumps of the second lift are installed above the RF level and cannot be put into operation without vacuuming; in addition, in the machine room of the 2nd lift of block No. 2 there are two wash pumps for washing filters.

of the wastewater treatment plant, the lack of an automated control system for the technological processes of water purification and pumping lead to an increase in the growth of losses of the enterprise.

One of the priority tasks is the introduction of new energy-saving technologies in non-stationary processes, allowing to achieve energy savings from 15 to 30% of its total consumption, and the costs of creating 1 kW of generating capacity range from 1,500 to 2,000 US dollars, while the costs for the introduction of modern energy-saving technologies, respectively, are equal to from 100 to 250 $ [1].

According to statistics, 120–130 billion kWh of electrical energy is spent on pumping clean and polluted water with hydraulic pumps in Russia throughout the year.

Reducing the cost of consumed electricity in pumping systems (pump, motor, installed pipelines) is solved mainly through the use of frequency-controlled drives for blowers [2].

In this case, the equipment operates most of the time in the area of high efficiency values and with the minimum permissible pressure, with the greatest energy efficiency.

However, regulating the drive of station pumping systems has a number of significant disadvantages when operating a group of parallel-connected units. The maximum flow rate of one pump is due to the minimum hydraulic resistance of the throttled pipeline, and with the correct choice of unit parameters, it is impossible to shift it to the region of high flow values. Therefore, the operating point is at the same time a boundary that prevents the unit from moving into the zone of possible cavitation and overloading of the drive motor.

When a group of parallel operating pumps is operating, any change in the state of any unit by turning it off or on, as well as adjusting the rotation speed of its impeller can lead to a redistribution of the load between the pumps, an increase in the supply of units with the risk of their into the zone of cavitation and overload of the drive electric motors and underload of the other group with the risk of them falling into the area of unstable operation and surge.

CONCLUSION

The stated goal of further work is to develop an algorithm for automatic control of a system of pumping units with the solution of a number of problems:

• selection of the type of drive used at the station;

• determination of the number of pumping units to be equipped with a variable electric drive;

• technological electrical parameters necessary to regulate the installation mode;

• ensuring the interaction of unregulated and controlled pumping units that represent the overall system at the station;

• determination of capital and reduction of operating costs, as well as payback periods for the system as a whole.

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