ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 12 , December 2021

Testing the methods of planning the production of electricity of the hydroelectric power plant on the basis of data on the factors that make up the flow

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ABSTRACT: this article is about the selection and testing of a model for planning the production of electricity in hydroelectric power plants based on information known at the time of prediction. Such data are water flow and atmospheric factors. Planning the volume of electricity production of the hydroelectric power plant will be considered on the basis of data on the amount of water reserves in the snow cover for the next quarter.

I. INTRODUCTION

Scientific research is carried out in Jaxon aimed at improving the methods of increasing the energy, economic and environmental efficiency of the hydroelectric power station systems, reducing the energy and resource consumption by developing methods of improving the operating modes of the hydroelectric power station. In this direction, in particular, through the development of forecasting methods for the efficient operation of hydroelectric power stations, studies on the determination and evaluation of the magnetism, reliability and stability of systems based on electricity and renewable sources are considered to be the priority. At the same time, the main task is to determine and evaluate the parameters of energy efficiency and regime, as well as the technical and economic indicators of the hydropower systems.

II. LITERATURE SURVEY

Most of the hydroelectric power plants are part of the structure of the two systems - the energy and water management systems, each of which ensures the development of many sectors of the economy [1,2].
The nature of the geological regime and the variability of its elements are directly related to the variability of climate and weather conditions in river basins. Therefore, unlike sciences such as physics and chemistry in geology, where development is based on laboratory experiments, it is necessary to use practical gidrometeorological observation data. The limited possibilities of the formation of such observations are associated with the complexity, unevenness and variability of natural processes, as well as the variety of physical and geographical conditions. They are mainly those who have a correct physical understanding of geological processes, but geology can not yet give a complete mathematical description of these processes and it is impossible to calculate them with a high degree of accuracy [3,4,5].

Multilateral studies of the tasks of planning the production of electricity and long-term regimes of hydroelectric power stations have been carried out and carried out by many organizations and research institutes. One to solve the complex

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International Journal of Advanced Research in Science, Engineering and Technology
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problems of long-term planning of gidroelectric power plant regimes is the well-known foreign scientists of great importance, including scientists L.C. Belyaev, A.The CI. Velikanov, V.M. Gshshteyn, T.L. Zalatarev, S.N. Krisky, M.F. Mengel, S.N. Nikitin, V.I. Obrezkov, A.Sh. Reznikovsky, G.G. Svanidze, E.V. Allaev K., one of our local scientists in solving scientific problems, such as the creation of Svetkov and gidroenergetikekseksP., Glovaskiy O.Eat it., Zakhidov A.Z., Zakhidov P.A., Muhammadiev M.M., Orishev B.U., Klichev Sh.I. and the results of the experiments were achieved by others, which were both successful.

III. MATERIAL AND METHODS

In the first variant of the structure of the planning model, it is taken into account the influence of the water reserve in the snow falling on the entire area of the hydroelectric power plant, which is considered only in the production of electricity of the hydroelectric power stations.

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})*(y_i - \bar{y})}{(n-1)*C_x*C_y} \quad (1)$$

here $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$, $\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}$, - mathematical expectation;

$C_x = C_v * \bar{x} = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$, $C_y = C_v * \bar{y} = \sqrt{\frac{\sum_{i=1}^{n}(y_i - \bar{y})^2}{n-1}}$, - the coefficient of variation of variables *x* and *y*, respectively.

The planned electricity generation (1) calculation formula was based on the determination of the r coefficient of correlation between the amount of water reserves in the snow for the corresponding measurement dates in the first quarter and the cost of electricity production in the second quarter of the hydroelectric power station.

The values of the norm of the water reserve in the snow and the calculated coefficients of mutual correlation are presented in Table 1.

The values of the correlation coefficients between the norm of water reserves in the snow and the amount of water reserves in the snow on the dates of measurement and the value of electricity produced from the current in the second quarter of 2010-2018 at the hydroelectric power station of the trench

Table 1

Hydroelectric power station	Snowdag water reserve measurement winter-spring months							
	The norm of water reserve in the snow, km^3	22,17	23,86	24,08	22,91	24,54	22,38	19,77
	Correlation coefficients, *r*	-0,85	-0,47	-0,40	-0,43	-0,45	-0,55	-0,17

$$y = b_0 + a*x$$

$$y = b_0 + a_2*x + a_1*x^2 \quad (2)$$

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$$\frac{\sum_{i=1}^{n} x_i}{n} = m_x^* = \alpha_1^*[X]; \quad \frac{\sum_{i=1}^{n} y_i}{n} = m_x^* = \alpha_1^*[Y]$$
$$\frac{\sum_{i=1}^{n} x_i^2}{n} = \alpha_2^*[X]; \quad \frac{\sum_{i=1}^{n} x_i^3}{n} = \alpha_3^*[X]; \qquad (3)$$
$$\frac{\sum_{i=1}^{n} x_i^4}{n} = \alpha_4^*[X]; \quad \frac{\sum_{i=1}^{n} x_i y_i}{n} = \alpha_{1,1}^*[X,Y]; \quad \frac{\sum_{i=1}^{n} x_i^2 y_i}{n} = \alpha_{2,1}^*[X,Y];$$

Due to the large volume of calculations, (2-3) according to the formulas, in the second quarter, the production of electricity by hydroelectric power plants in the first quarter, we use computer processing methods to determine the types of connections to the value of snow water reserves.

(2-3) the coefficients of the equation obtained in the calculation of the formulas are given in Table 2 by the example of the Charvak hydroelectric power station for the condition selection of the types (2.3) of dependence of the gidroelectric power station on the production of electricity in the next quarter.
In the second quarter from the amount of snow water reserves in the first quarter, an approximation method is used to determine the projected equation of dependence of the hydroelectric power generation on the production of electricity [6,7,8,9].

Table 2

		$y_1=a_1*x+b_0$		$y_2=ai*x^2+a_2*x+bo$		
		a_1	bo	a_1	a_2	bo
Charvak Hydroelectric power station	Winter	-0,0089	0,66	-0,0024	0,0271	0,3168
	Spring	-0,0063	0,434	-0,0023	0,0312	0,2831

IV. SIMULATION & RESULTS

The calculation of the planned electricity production at the hydroelectric power plant was carried out according to the data for February, according to the forecast, the value of the water reserve in the snow for this month is the maximum, and the data for the beginning of the next month are also correct, since for this time the planning of the production.
In Figure 1, the next quarter will include the volume of electricity production in the winter season, which will link the production of electricity of the Char hydroelectric power plant, respectively, and in the period from 2010 to 2018 year in the spring season, depending on the level of water supply in the snow.

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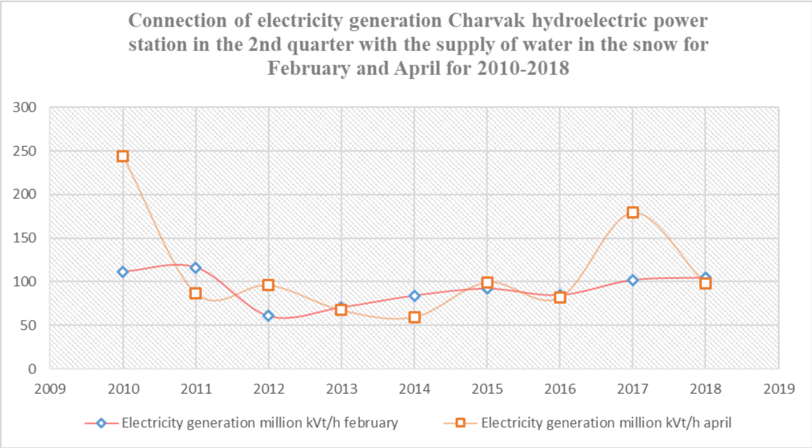


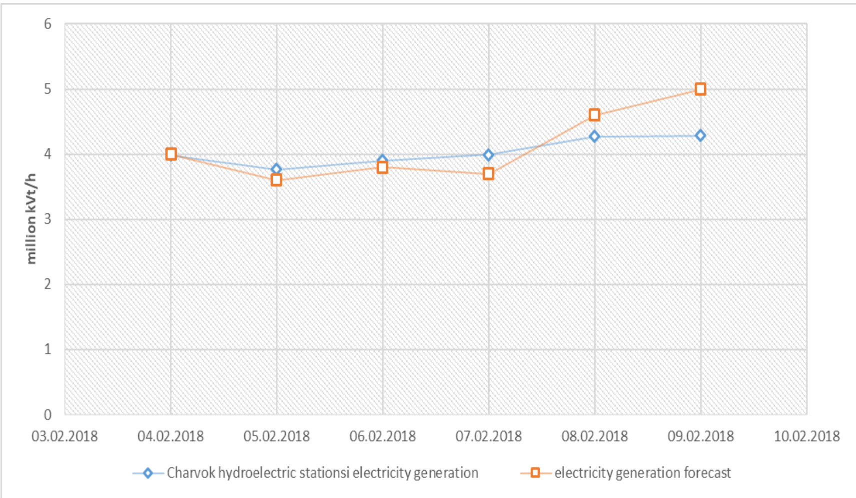
(3) to perform calculations for selecting the connecting curve by formulas and (1) taking into account the condition, the following linear function is adopted as the approximator connecting:

$$y=a*x+b_o, \quad (4)$$

here bo - is the free aze of the equation, a is the coefficient of the equation.
a and bo the values of the coefficients are determined by the method of the smallest squares for all dates of measuring the water reserve in the snow in the first quarter.

Similarly , having carried out calculations for the Charvak hydroelectric power station , we obtained predictive equations of the following form: February average y=-0,009*x+0,690 , April average: y=-0,006*x+0,534. here: y-the next quarter, the production of electricity from the hydroelectric power plant,; x-depends on the water reserve in the snow on the date of the corresponding measurement.

The values obtained for the actual and projected equations of electric power generation values for the Charvak hydroelectric power station are given in 2 Pictures respectively.



1-figure. Actual and forecast electricity generation calculated on the basis of data on the water supply in the snow February Charvak hydroelectric power station.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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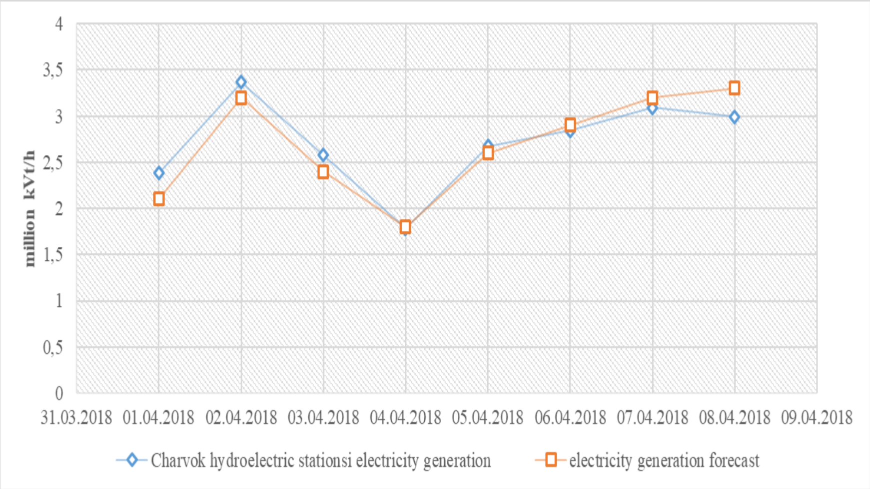

2- figure. Actual and forecast electricity generation calculated on the basis of data on the water supply in the snow april Charvak hydroelectric power station.

It should be borne in mind that when assessing the quality of the planning model, we can predict the projected value of the production of electricity of the hydroelectric power plant according to this method, in contrast to the method of forecasting the production of electricity of the hydroelectric power plants on the basis of water flow data for the next quarter.

V. CONCLUSION

The conducted analysis of the reliability obtained on the basis of the forecast equation of the values of electric power generation of the Charvak hydroelectric power station in the next quarter showed the feasibility of using the developed methodology for planning the amount of electric power generation by hydroelectric power plants in the next quarter..

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