SAFETY OF HYDRAULIC STRUCTURES

ON THE POSSIBILITY AND EXPEDIENCY OF ELECTRIC HEATING AT KOLYMA

V. A. Pekhtin

The power supply of marginal territories of Russia – the Far East and Northeast – under conditions of transition to market relations is characterized by the occurrence of a fuel and energy crisis which has lasted for a number of years. In connection with the sharp increase of the price of fossil fuel, failure to pay for electric and thermal energy being consumed, and the impossibility of power-producing enterprises to pay for fuel deliveries, the fuel and power industry is forced to operate under extreme conditions. Enterprises of the fuel and energy complex are gradually falling into decay and it is increasingly more difficult for them to provide normal functioning of other sectors of the economy.

A more favorable situation with the power supply is developing in regions where the proportion of hydroelectric stations, for which it is not required to mine and sell fuel and nature delivers water regularly, is high in the production of electricity. Hydrostations are now unique donors and creditors of insolvent consumers and in a number of cases are saving the economy from total collapse.

In the Magadan region problems of power supply are as acute as in other regions of the Far East.

The problem of power supply of the Magadan region can be solved by using the hydropower resources of the upper reaches of the Kolyma River flowing through the Magadan region. As foreign experience shows, in regions with a high proportion of hydrostations the use of electric heating is quite effective in an economic, ecological, and social aspect. The use of electricity for supplying heat has still not become widespread in our country. Electricity was used on a limited scale in regions where there was cheap energy of the Irkutsk, Bratsk, Krasnoyarsk, and Kolyma hydrostations. The large diamond-mining region in Yakutia became the precedent, when after putting the Vilyui hydrostation with a carryover reservoir into operation its electricity began to be used without limitation for heating needs.

Electric heating is used rather widely in an implicit form in the Magadan region: the population and enterprises in the winter actively use electric heaters, which accounts for 40-50% of all electricity being consumed. This is confirmed by the annual graph of the production of electricity shown in Fig. 1, from which it is seen that summer electric power consumption after 1991 steadily declines and winter consumption increases. This increase became especially noticeable in the 1998/99 winter, when after completing the last stretch of the 220-kW transmission line Magadan city received additional power from the Kolyma hydrostation.

The Magadan region has rich hydropower resources able to completely supply power to the region not only in the near but also the distant future. The Kolyma hydrostation produces 90% of all electricity being consumed in

the region, which makes it possible to save more than 1 million tons of coal annually. The Magadanénergo central power center (CPC) does not have electrical connections with other power systems of the country, it operates under isolated conditions, and therefore all electricity being produced can be used only within the region. The heat-supply systems of the region are a large and stable consumer of electricity.

With the completion of the construction of the Ust'-Srednekan hydrostation the consumption of coal in the region will decrease an additional 700,000 tons. In the more distant future, with the construction of the dam-regulator of the Upper Kolyma hydrostation providing carryover regulation of the upper course of the Kolyma River, it will be possible to do away almost completely with the use of coal in the Magadan region.

The prime cost of electricity being produced at the hydrostation is 10-15 times lower than the prime cost of electricity being produced at other electric power stations using fossil fuel. This circumstance created favorable prerequisites for restoring industrial production in the region and increases the competitiveness of the products being produced. The use of electricity for heating on a large scale was not permitted in the past because of the shortage of electric power and more expensive production of thermal energy by using electricity being produced at thermal power stations. The efficiency of electric heating depends mainly on two factors: electric power rate and cost of fuel and its consumption at an alternative coal-fired boiler house heat-supply source. But, as we indicated above, the prime cost of electricity produced at a hydrostation is an order lower than the cost of electricity produced at thermal power stations, and in connection with the rapid increase of the price of fossil fuel the price of electricity of a thermal power station inevitably increases, whereas the price of electricity of a hydrostation increases incomparably more slowly.

The situation with the power supply of the Magadan region during the past 7-8 years changed substantially, and therefore of definite interest are the works [1, 2, 3] on substantiating the use of electricity for heating industrial facilities and populated areas of the Magadan region. We will examine the results and conclusions of these works below.

In the work of the Siberian branch of the Russian Academy of Sciences [2] basic capital investments in a coal-fired boiler house and in a electrical boiler house in 1991 prices with consideration of the inflation factor of an increase of prices for 1995 at the level of 2500 and range of prices for electricity from 0.5 to 0.6 cents/kWh and for coal from $10 to $100 per ton were used for comparing heat-supply variants. The selection of the dollar equivalent of the ruble was made, obviously, in connection with the high rate of inflation processes. The work gives a nomogram (Fig. 2) determining the line of the boundary conditions of equal economy of the two examined heat-supply systems. At a rate for electricity of 5.8 cents/kWh and cost of fuel of $20-70/kWh at Magadanénergo in 1995, the heat-supply system from an electric boiler house is economically ineffective compared with the coal-fired boiler house. We will use the nomogram for determining the effectiveness of the two heat-supply systems under conditions of inflationary processes in the economy during 1992-1998. Table 1 gives the approximate rates for electricity and coal prices tied to the general dollar rate. We stipulate at once that the general dollar rate in an annual aspect is taken at a certain time and is not the average annual, which, just as an overstated dollar rate relative to the ruble, is not completely correct.