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KAMCHATKA GEOTHERMAL RESOURCES DEVELOPMENT: PROBLEMS AND PERSPECTIVES

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ABSTRACT

There are four long-term exploited geothermal fields in Kamchatka: one steam-water field Pauzhetka (south of Kamchatka peninsula) and three hot water fields: Paratunka (near by town of Petropavlovsk-Kamchatsky) and Esso and Anavgay (center of peninsula). Pauzhetka and Paratunka fields are exploited during almost 28 years. Esso and Anavgay fields are exploited during 25 years. In Pauzhetka 11 MWe geothermal power plant work and on the other fields thermal energy of hot water is directly used. Kamchatka region satisfies energetic demands mainly by organic imported fuels. At the same time electricity produced by geothermal fluids constitutes less than 2 per cent of total region electricity production, and thermal energy produced by geothermal fluids constitutes less than 3 per cent of total region thermal energy production.

The main reasons of small geothermal portion in the energy production balance of Kamchatka are briefly discussed. The geothermal development reserves and perspectives of geothermal energy use increase in Kamchatka are outlined.

ELECTRICITY PRODUCTION

Total potential power of Pauzhetka geothermal plant is 11 Mwe, but maximum production power in 1994 year was less then 6 MWe. At the same time half of 28.5 kg/sec produced steam of production wells discharges to atmosphere without any use. The present resources of geothermal steam of Pauzhetka field are 40,6 kg/s at average pressure 2,6 atm and allow to produce more than 12 Mwe electricity energy. The 95 per cent of residual hot water 241 kg/s with mean enthalpy in quantity 191 kcal/kg is not used now anyway. This situation is caused by large distance 30 km between Pauzhetka field and main energy consumer, namely Ozernovsky fishing cannery (Fig.1). Nevertheless, 2,2 MWe diesel

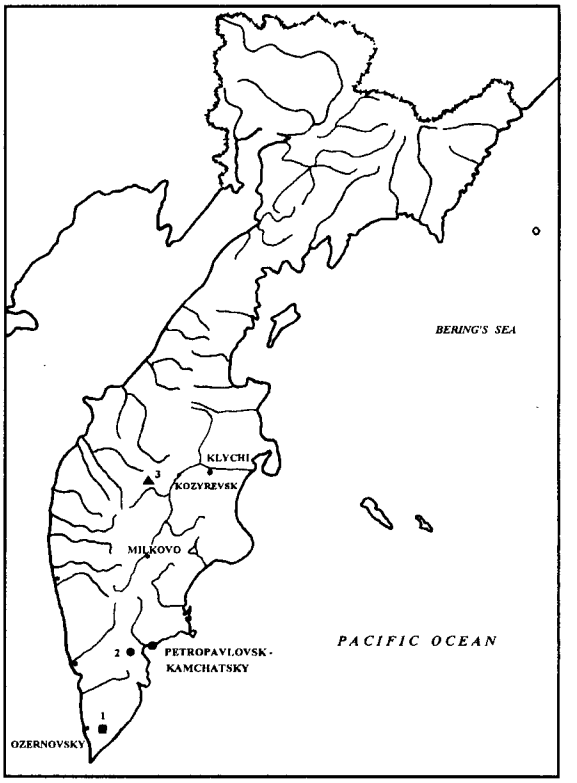

Fig. 1. Location of the Kamchatka long-term exploited geothermal fields. 1.-Pauzhetka; 2. - Paratunka; 3 - Esso and Anavgay.

power plant and fluid fuel boiler house works in Ozernovsky. It is just geothermal heat resources of Pauzhetka fields can exceed heat and electricity demands of Ozernovsky more than 3 times provided construction of thermal water duct from field to consumer and reconstruction of geothermal power plant. Works on increase of Pauzhetka geothermal power plant, started in 1990, are hampered now due to financial reasons. Besides, as it turns out, total financial investment in all stages of Pauzhetka geothermal project from 1958 up today, including construction of power plant, still is not compensates in general sense. Main reason of that is excessively detail explore

drilling in 1958-1963 and 1972-1976 periods. Nevertheless, in new market conditions, since 1994 the electricity of Pauzhetka geothermal plant is very profitable in comparision with energy of standart fuel plant. The Pauzhetka field production history is presented on fig. 2, 3.

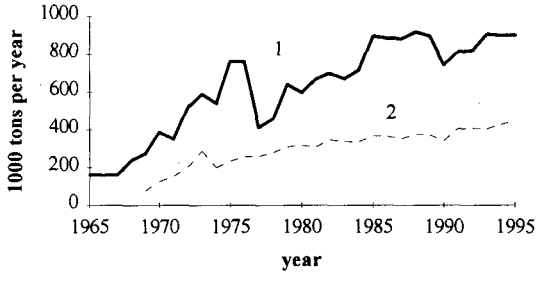

Fig. 2. Production (1) and sales (2) history of geothermal steam of Pauzhetka field.

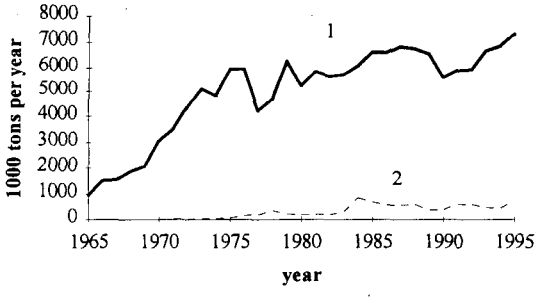

Fig. 3. Production (1) and sales (2) history of geothermal water of Pauzhetka field.

Thus, there is incomplete use of already accessible geothermal resources of Pauzhetka steam-water field, caused by absence of enough great consumers just on the spot and technical and financial problems of construction and reconstruction of present and new facilities.

THERMAL ENERGY USE

Accessible resources of Esso geothermal water field is 148,2 liter/s of industrial category. Average temperature of water is 75°C. Average production rate of thermal water was 167.6 liter/s in 1994. Esso field production history is presented on fig. 4. The 25 consumers use of Esso geothermal water. Exploitation of Esso field is commercially profitable during all period of 1971 - 1995. More over, in present time additionally amount of geothermal heat is needed to satisfy consumer's demands. At the same time temperature of used thermal water after technological facilities is 63-70°C. So needed additional amount of geothermal water heat can be compensated by lowering of residual water temperature. The thermal energy power of Esso field, provided that residual water temperature will be 30°C, constitutes almoust 220000 Gcal/year. Thus useful pick out of geothermal water thermal energy of Esso field is smaller than accessible more than 3 times. The constraint of this possible progress is absence of consistent heat-exchanger and heat pumping facilities in Kamchatka.

Accessible resources of Anavgay geothermal water field is 39 liter/s. Mean temperature of thermal water is 76°C. Anavgay field production history is presented on fig. 4. Main consumer of geothermal heat is Anavgay deer-breeding farm. Aim of geothermal water use is space heating. Average production rate of thermal water was 34 liter/s in 1994. There is situation of incomplete geothermal water heat use in Anavgay as in Esso. In 1994 year only half of accessible heat of thermal water was used because of high temperature of residual water.

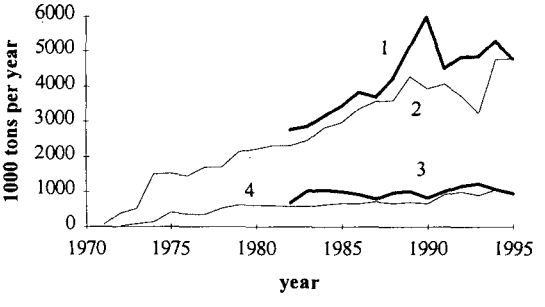

Fig. 4. Development history of Esso (1 -production; 2 - sales) and Anavgay (3 production; 4 - sales) geothermal water fields.

Accessible resources of Paratunka geothermal water field is 270 liter/s. Average production water temperature of its parts is 68, 78 and 81°C. Average production rate in 1994 was 221 liter/s. Paratunka field production history is presented on fig. 5. Thermal water is used for space heating, heating of greenhouses and for swimming pools of many camps and sanatoriums. Exploitation of this field is commercially very profitable, because geothermal heat cost is smaller than cost of boiler-house heat more than 5 times. Nevertheless there are scarcity of geothermal water for sufficient heating of houses in winter time. At the same time mean residual water temperature is more than 60°C. So the effective geothermal heat-exchangers and

possible heat pumps are needed, as in Esso and Anavgay.

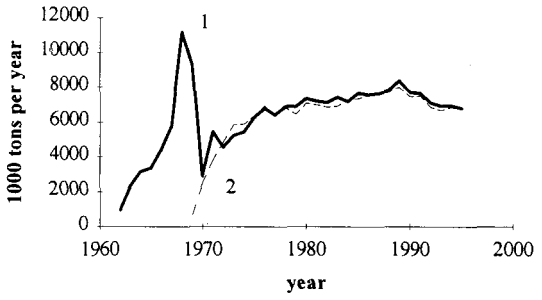

Fig. 5. Production (1) and sales (2) history of geothermal water of Paratuntka field.

Thus, there is incomplete use of accessible geothermal heat energy in the all long-term exploited hot water fields in Kamchatka.
The situation caused by absence of technical and financial possibilities for effective pick out of geothermal water thermal energy.

SUMMARY

In present time Kamchatka geothermal resources development is hampered by technical, technological and financial reasons and mainly impossibility of access to advanced geothermal technologies.