GEOTHERMAL ENERGETICS AS THE BASIS FOR STRUCTURAL RECONSTRUCTION OF ENERGY PRODUCTION IN KAMCHATKA

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ABSTRACT

The concept of reorientation of energy production in Kamchatka is discussed based on utilization of Kamchatka's own energy resources. The coiicept is based on the abilities of "Kamchatskenergo" and considers realistic projects of construction of geotlieriiial and other power plaiits. Geothermal deposits are given tlie exclusive role in reconstructing the energy industry in Kamchatka. Technical solutions are presented on tlie construction of geothermal power plants.

1. INTRODUCTION

The stock-holding company "Kamchatskenergo" is tlie principal producer of electricity in Kamchatka (92%) aiid simultaneously plays an important role in supplies of lieat in the city of Petropavlovsk-Kamchatksky. At present the energetics of Kaiiicliatka is based on utilization of imported fuel. Tlie remoteness of the region accounts for high cost of tlie fuel and, as a consequence, very high cost of electricity (USD 0.06 per 1 kWh) wliicli negatively influences the economy of tlie region in general. At the same time the region has its own fuel-energy resources. Local geological companies testify that total potential of geothermal deposits exceeds the existing level of energy coiisumption in Kaincliatka.

The reasons indicated point to tlie urgent necessity of structural reconstruction of energy production in Kamchatka with proper attention to local energy resources. The concept presented in this paper of utilization of local fuel-energy resources is based on the realistic abilities of "Kamchatskenergo" aiid includes projects of construction of energy producing plants such as the Mutnovsky geothermal platit and reconstruction of the Pauzhetka geothermal power plant.

2. CHARACTERISTICS OF KAMCHATKA ENERGY SUPPLYING SYSTEM

The eiiergy supply systeiii of Kamchatka is autonomous and its transmission lines are iiot linked to otlier systems of Russia. Its peculiar feature is that there is a lot of small remote consumers and one big consumer wliicli iiicludes tlie cities of Petropavlovsk-Kamcliatsky, Elizovo and their suburbs. The capacity of established power plants totals 529 MW, the quantity of electricity supplied to consumers in 1993 amounts to 160000 MWh. Tlie biggest power plants are TEZ-I (259 MW) and TEZ-2 (160 MW) located in the city of **Petropavlovsk-Kanicliatsky.** Apart from production of electricity these plants produce liot water for central heating and domestic liot water. These plants use liquid fuel (rnazut) delivered to Kaiiicliatka by sea.

Besides TEZ-1 and TEZ-2 tlie energy system is comprised great number of autonomous diesel power plants tliat provide energy for remote consumers. Tlie energy systeiii also includes tlie only geotliermal power plant in Russia which is located at tlie Pauzlietka geotlieriiial field. This platit started operation in 1967 and has tlie established capacity of 11 MW. However, tlie maximum capacity of the plaiit is limited by existiiig systeiii recovery and transportation of tlie geotlieriiial steam aiid water and in fact amounts to 6 MW. The difference between established and actual capacity results from tlie fact tliat tlie plant equipment is very old and often requires repairment. Nevertheless, the Pauzhetka geotlieriiinl power platit has the lowest cost of produced electricity as compared to the otlier power plaiits of Kamchatka as a result of low cost of geothermal steani.

The existiiig energy production in Kamchatka from local resources account for only for 1.6% of tlie produced electricity, whereas 98.6% is produced through using fuel wliicli is brought by sea (mazut and diesel).

3. PLANS FOR THE DEVELOPMENT OF AN ENERGY INDUSTRY IN KAMCHATKA.

According to tlie forecast of Kamchatka regional administration and "Kamchatskenergo" until 2000 tlie level of consumption of electricity will stay at tlie existing level (about 1700000 MWh). By 2005 it will go up to 1800000 MWh and by 2010 - to 1900000 MWh.

Plans for the development of an eiiergy industry in Kamchatka are associated principally with construction of geotlieriiial power plants. At present transmission lines aiid highways are under construction that will connect the Mutnovsky geothermal field with the cities of Petropavlovsk-Kamchatsky and Elizovo (the distance is 80 km and 110 kin, respectively). This will be followed by tlie coiistruction the Mutnovsky power plant. This work is financed by the Russian Government. Tlie first stage of tlie platit (SO MW) is planned to be put to operation in steps in 1998 to 2001 (by 20 MW each year). Existing production wells produce enough steam to provide tlie first stage of the plaiit. By 200.5 it is planned to put into operation the second stage of the plant with the capacity reaching 184 MW. Tliis will require development of existing wells aiid drilling of new productioti wells. In the process of exploitation of tlie first stage of the plant it is proposed to define tlie resource and to study possibilities to broaden tlie capacity of the plant. Up to now tlie resources for the first stage have been fully proved aiid for the second stage they have been proved with high degree of probability.

Tlie Mutnovsky geothermal power plaiit will merge with the unified net of TEZ- aiid TEZ-2. Because of complex climactic aiid geographic conditions this power plant will work in the regime of constant capacity. Calibration of tlie capacity in the net will be carried out through calibration of capacities of TEZ-1 aiid TEZ-2.

At present the project for reconstruction of tlie Pauzlietka geotlieriiial power plant has been approved. This project foresees complete replacement of the existing equipment wliicli will make it possible to increase the capacity of tlie plant to 12 MW by 2000 and to IS MW by 2005. However, the work on tlie project has not yet been started as a result of difficulties with financing. Tlie Pauzhetka power plant is not linked to big consumers and existing coiisumers are not able at the moment to finance this project.

Further plans for development of the geotlieriiial energy in Kamcliatka ate associated with developiiieiit of Koshelevsky geotlieriiial deposit. Based on tlie geologic data that includes well drilling, the resources of this deposit are very

similar to that of tlie Mutnovsky but the latter is **closer** to tlie biggest consumers. Tlie Mutnovsky geotlieriiial field lias also been considered as the possible supplier of lieat for the cities of Petropavlovsk-Kamchatsky **aiid** Elizovo. "Kamchatskenergo" lias indirect participation in this project being one of tlie founders of tlie company, specially created for **this,** "KamTEC".

Familiarization with the experience of colleagues from Iceland wliicli lias similar geograpliic conditiolis initiated elaboration **of** tlie projects on construction of hydro power **plants.** By 2000 two hydro power plants with tlie total capacity of 4 MW on **tlie** Bystraya river **arid** by 2005 **n** net of such plants with the total capacity of 45 MW on the Tolmacheva river. To supply electricity to some villages in the west of Kamcliatka it is planned to construct a power **plant in** tlie village of Sobolevo that will utilize natural gas found in the vicinity of tlie village.

4. THE PRINCIPAL TECHNICAL SOLUTIONS FOR CONSTRUCTION OF GEOTHEKMAL POWER PLANTS

Working out technical solutions for construction of geothermal power plants in Karncliatka considered the following geographic and climactic peculiarities of tlie region: remoteness of the fields, periods of bad weather that will hinder construction work, heavy snowfalls in winter, etc. Thus, out of several projects the Kaluga turbine **platit** lias been approved and accepted wliicli is based on the construction of individual energy production blocks.

This coiicept assumes installment of autonomous energy blocks of maximum plaiit readiness close to the wells with subsequent collection **of** produced energy. Tlie Kaluga turbine **plant** offered a set of eiiergy blocks with the capacity of 2 to 23 MW each. Energy blocks are designed in such a way that they are suitable for transportation. This approach enables one **to** shorten the period of construction-assembling work as weii as to simplify the scheme for transportation of steam arid water.

It is planned to install four energy blocks, each having tlie capacity **of** 23 MW for the first stage of the Mutnovsky geothermal power plant and four more blocks with the same capacity for tlie second stage.

Steam-water mixture is the lieat carrier. This mixture undergoes two stages of separation at tlie pressure **of** 0.7 MPa: primary separation arid secondary separation with washing the steam wliich will allow one to decrease tlic concentration of salts. Tlie washed steam **is** supplied ***to*** the turbine after which it goes io tlie air condenser. Tlie brine from the separator as well as the water with tlie dissolved gases from tlie condenser is pumped through special pipes to reinjection wells. During design **of** energy blocks tlie possibility for using hot thermal water for heating fresli water was also taken into account wliicli will enable one to use every block for both production of electricity and lieat.

At tlie Pauzhetka geothermal powei plant it is planned **to** install three energy blocks each with the capacity of *6* MW. **As** far as tlie technology of recovery and transportation of steam-water mixture witli separation **at** the wells has been mastered already, it is planned to supply steam to tlie block at the pressure of 0.2 MPa. In case of Pauzlietka geothermal power plant no washing of the steam is required. Since the basic difficulties of exploitation of tlie existing plant are related to water supply for condensation of steam it is assumed **to** use air condensers.

5. CONCLUSION

In tlie coming 10 years we plan to reconstruct energy production capability of Kamchatka. In the course of this reconstruction we assume **to** decrease tlie dependence on imported fuel. We also have grounds **to** assume that the tendency to utilize our indigenous resources will prevail in the future. However, the specifics of energy consumption aiid purposeless *of* calibration of the Mutnovsky geothermal power plant do **not** allow us to plan full transition to Kamchatka's own energy resources, at least in the foreseeable future.

The principal role in the reconstruction of tlie energetics in Kamchatka is given to geothermal energy. Today all principal technical problems **of** construction of the Mutnovsky plaiit and reconstruction of tlie Pauzlietka plant have been solved. The practice of **running** the Pauzlietka geothermal power plant demonstrates that it is quite feasible to decrease the *cos:* of electricity through tlie implementation of these project?. This will also a-eate favourable economic conditions for Kamchatka in general.

6. REFERENCES

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