

Pricing and Usage of Geothermal Energy of the Paratunsky and Pauzhetsky Geothermal Fields, Kamchatka, Russia

N.I. Kiryukhina

Kamchatskburgeotemia Enterprise, Krashenninnikova-1, Thermalny, Kamchatka, Russia, 684035

NinaKiryukhina@mail.ru

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ABSTRACT

Kamchatskburgeotemia SUE operates most of the geothermal fields of Kamchaka, except Mutnovsky, to sell geothermal energy (hot water and steam) to consumers. Paratunsky hot water fields and Pauzhetsky high temperature field allow to produce and sell 4.81 million ton of hot water and 0.88 million ton of steam annually.

Nevertheless the significantly lower (2.5-14.5 times less) market price for geothermal energy, compared to oil-based energy supply, reduces the possibilities for geothermal project development. This is due to current price law regulations, which applied single rules to all energy markets (coal, gas, oil and geothermal - Federal Law, 1995; Order, 2008). These single rules did not account for production development fund deductions and restricted profit rate, which cut geothermal prices.

Hence, the price issue regulation for geothermal is critical for future geothermal development in Kamchatka. In the case of geothermal price question resolution, the most feasible geothermal projects are: 1. Transportation of the unused 240 kg/s 120 °C hot separated water from Pauzhetsky geothermal field for district heating of the Ozernaya village and fishery, located 30 km away, and replacement of the inefficient Pauzhetsky power plant turbine; 2. Kick off Upper-Paratunsky field to yield 270 kg/s hot water at 80°C to Elizovo and Viluchinsk cities and local applications (full scale greenhouses and ski resort).

1. INTRODUCTION

Kamchatskburgeotemia SUE operates most of the geothermal fields of Kamchaka, except Mutnovsky, to sell geothermal energy (hot water and steam) to consumers (Fig. 1). Geothermal water in Kamchatka is used mostly for district heating of remote villages, where this is the only available source of energy. Steam is sold to Pauzhetsky Geothermal Power Plant with installed capacity 11 MWe.

2. PARATUNSKY FIELDS

Paratunsky fields (Paratunsky and Upper Paratunsky) are the closest sources of accessible geothermal energy to Petropavlovsk-Kamchatsky city, located 40 km to the south-west in Paratunsky valley. Kamchatskburgeotemia SUE is responsible for exploitation of these fields. Exploitation reserves of the Paratunsky geothermal field amount to 188.7 kg/s, with average wellhead temperature 73°C (A+B+C1). Exploitation reserves of the Upper Paratunsky geothermal field amount to 269.7 kg/s, with average wellhead temperature 76.5°C (B+C1).

Main applications of Paratunsky fields thermal waters include: 1. District heating and hot technical water supply

to Paratunka and Thermalny villages; 2. District heating and thermal water supply to swimming pools and hotels of the Paratunka recreational zone; 3. Balneological thermal water use. Table 1 shows thermal water users and their rates of thermal energy consumption.

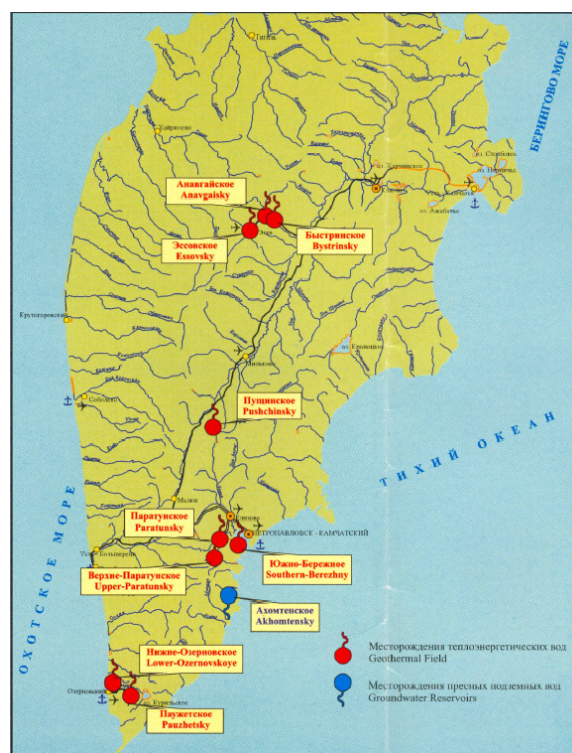


Figure 1: Schematic map of geothermal fields, which operated by Kamchatskburgeotemia Enterprise.

Table 1: Annual thermal water consumption from Paratunsky fields

Consumers	Annual consumption	
	10 ³ Gcal	10 ³ m ³
Paratunsky Field		
Local population	44.2	2378.1
Hotels and swimming pools	68	2338.1
Upper Paratunsky		
Hotels and swimming pools	2.6	93.1

Table 2 shows comparative data of the Paratunsky fields exploitation reserves vs. actual consumption. As seen from this table, usage fractions of the Verkhne-Paratunsky and Paratunsky fields are 1.1% and 79.3% respectively. Full usage of the geothermal resources of the Paratunsky fields would be possible in the case of the appearance of new consumers in the geothermal market.

Table 2 Comparative data of exploitation reserves and consumption of thermal waters in Paratunsky geothermal fields.

Geothermal Field	Consumption rate, kg/s	Exploitation reserves, kg/s	Usage %	Non usable reserves, kg/s
Paratunsky	149.7	188.7	79.3	39
Upper Paratunsky	3.0	269.7	1.1	266.7

Promising new directions of geothermal energy use in Paratunsky valley are: 1. Building full scale greenhouse facilities in Thermalny village; 2. Construction of the Downhill Ski Resort with associated hotels; 3. Creating the aqua-park in Elizovo city; 4. Transportation of the Upper-Paratunsky hot water for district heating of Viluchinsk city.

2. PAUZHETSKY FIELD

Pauzhetsky geothermal field is the only high temperature geothermal field in Kamchatka owned by Kamchatskburgeotermia SUE. Details on Pauzhetsky geothermal field can be found in Kiryukhin et al. (2008). Steam is sold to Pauzhetsky Geothermal Power Plant with installed capacity 11 MWe. Unused 240 kg/s 120 °C hot separated water from Pauzhetsky geothermal field is put into Pauzhetsky river at this time – although it could be used for district heating of the Ozernaya village and fishery, located 30 km away. Another plan may consider replacement of the inefficient Pauzhetsky power plant turbine, which may increase electricity generation up to 65%.

3. PRICING

The rules for price formation of heat energy are single in Russia for all available energy resources: coal, gas, oil, geothermal steam and thermal water.

Price for the geothermal energy (hot water and steam) is regulated by the Kamchatka Regional Price Committee. All prices should be approved by Committee and put into operation on January 1st. State regulation limits profit to a value of 3%.

Geothermal energy price calculations include estimations of expenses and profit. Expenses are split into direct (variable) expenses (depending from sales gain) and conditionally constant expenses. Direct (variable) expenses include also personnel salaries with taxes, materials, electricity and gasoline. Conditionally constant expenses include amortization of base equipment, monitoring and other expenses. It also includes expenses on production development, social needs, loan interest rates, profit tax and others (Order, 2004).

These rules of the price formation for geothermal energy (no fund deductions for production development allowed, profit rate restrictions) – do not allow sufficient money for geothermal development.

Market prices for geothermal energy are significantly lower than prices for oil based energy supply. For example, the price for geothermal water for residents of the Paratunka and Thermalny villages is 1168 rubles per 1 G cal, while

district heating price for residents of the Petropavlovsk-Kamchatsky is 2916 rubles per Gcal.

The same is true for electricity. Pauzhetsky steam price is 32.99 rubles per 1000 kg (that is equivalent to 70 kW-h), or 0.47 rubles per kW-h equivalent. The price for 1 kW-hr from the oil-fired power plant in Petropavlovsk-Kamchatsky is 2.9 rubles for the population and 6.86 rubles per 1 kW-hr economical feasible.

4. CONCLUSIONS

The price regulation issue is critical for future geothermal development in Kamchatka. “Cheap geothermal energy” does not allow sufficient money for geothermal development. Geothermal development in Kamchatka depends also on external investments and loans. Nevertheless, to get external investment, sustainable creditability of the thermal water Producing Company is needed. This is difficult to achieve when the most consumers are local people, whose full payments are not guaranteed, while shortage of the heat supply to residents is prohibited by Law.

If this price regulation problem will find solution, then possible development of geothermal projects in Kamchatka may consider transportation of the unused 240 kg/s 120 °C hot separated water from Pauzhetsky geothermal field for district heating of the Ozernaya village and fishery, located 30 km away. Another project may consider replacement of the inefficient Pauzhetsky power plant turbine, which may increase electricity generation up to 65%. Paratunsky fields may yield 306 kg/s of hot water for possible new applications: full scale greenhouses facilities, downhill ski resort with associated hotels, Aqua-park in Elizovo city and district heating of Viluchinsk city.

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REFERENCES

- Kiryukhin A.V., Asaulova N.P., Finsterle S. “Inverse Modeling and Forecasting for the Exploitation of the Pauzhetsky Geothermal Field, Kamchatka, Russia”, *Geothermics*, V. 37, 2008, p. 540-562.
- Federal Law of 14.04.1995 №41-Φ3 (edition of 25.12.2008) «On State Regulation of Electricity and Heat Energy Prices in Russia Federation».
- Order of the Federal Prices Survey of 06.08.2004 №20-7/2 (edition of 21.10.2008) «On Approval of Guidelines for Prices Calculations on Electrical (Heat) Energy on Consumers Market» (recorded in Legislation Ministry of RF of 20.10.2004 №6076).
- Order of the Government Russia Federation of 14.07.2008 №520 «Basics of the Prices Formation and Regulations, Additional Payments and Restriction Indexes in Community Services Business».