

## UTILIZATION OF GEOTHERMAL ENERGY FOR DEVELOPMENT OF PROVIDIBLE SYSTEMS OF TOURISM AND SPORT OBJECTS IN RUSSIA AND GERMANY

В работе изложены результаты проведенного исследования в рамках Проекта Центра геотермальной энергетики при Университете прикладных наук Бохум, Германия. Источники геотермальной энергетики уже успешно используются на различных объектах промышленно-гражданского строительства в Европе. Целью данной работы стало определение возможностей использования данного вида возобновляемой энергии на объектах туризма и спорта в Российской Федерации. Проанализированы методики и подходы к обоснованию, существующие Концепции и эксплуатируемые объекты. Сделаны обобщения, рекомендации и выводы.

The purpose of the given research is the substantiation of necessity of use of geothermal energy, as decentralized source of supply of sport and tourism objects; consideration of the European experience (Germany) in sphere of application of the geothermal process equipment in public buildings. In new conditions of development of the real estate of resorts, tourism and sports the special role is borrowed with processes of reception and consumption of energy and heat, responsible necessary microclimatic conditions both internal, and an external zone of objects of leisure and rest. The domestic modern technological infrastructure of housing and communal services offers the centralized order of granting of services to the population (water-, heat-and power supply). It is accompanied traditional long-term, expensive with greater losses with transportation of services. Thus the majority of structures and communications serving a decayed and them demands modernization and technological innovation.

Practically in all territory of Russia there are geothermal resources with temperature from 40 up to 300<sup>0</sup>C, having practical application. Systems of the geothermal centralized heat supply basically are applied in the Europe. In the USA systems of geothermal heating of separate buildings and constructions prevail. Most actively and widely developed (in 26 countries) geothermal heat pumps (GHP). GHP it is intended for transfer of internal energy from the heat-carrier with low temperature to the heat-carrier with a heat. A source low temperature heat can be energy of an environment and fulfilled heat, including geothermal heat грунтов and underground waters and other [1].

The wide circulation in the world (Germany) was received with next ways of extraction of primary heat: chinks with geothermal water; horizontal soil borehole; heat exchange of type «a pipe in a pipe»; constructional borehole in support of the bases and elements of designs of buildings (see Figs. 1-4).

For arrangement of landscape zones, athletic fields (football, ice weeding, pools and other), use of heat exchange of type «the pipe in a pipe» is the most preferable.

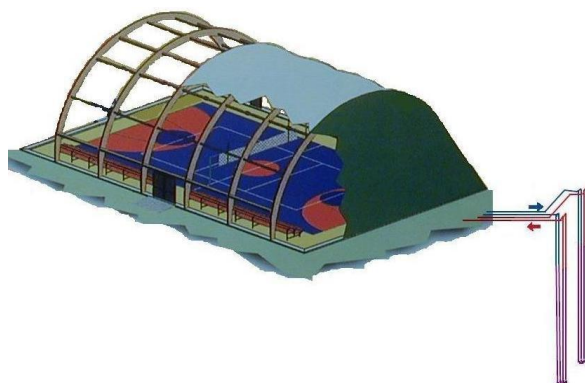


Fig. 1. Closed loop heat pump systems;  
geothermal water



Fig. 2. Open loop heat pumps chinks with  
systems; horizontal soil borehole

Fig. 3. Heat exchange of type «a pipe in a pipe»

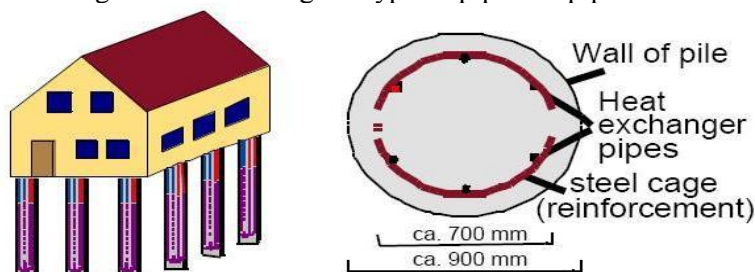


Fig. 4. Constructional borehole in support of the bases and elements of designs of buildings [3]

Some economic benefit can be achieved by combining heating and cooling in a system with combining heating and cooling would be higher than the factor for heating alone, and the unit energy price would consequently improve (Gudmundsson, 1988). The refrigeration effect is obtained by utilizing two fluids: a refrigerant, which circulated, evaporates and condenses, and a secondary fluid or absorbent [2].

The share of the power expenses necessary for work of system depends on depth of an arrangement exchange warm, climatic and hydro-geological conditions of area. In a general view of an expense of electricity make 1 kWt on reception of thermal energy of 3-5 kWt. So high factor of transformation does geothermal systems very interesting from the point of view of profitability and efficiency.

Direct heat is one of the oldest, most versatile and also the most common form of utilization of geothermal energy. With 2000 actively conducted a research with application of interrogations of experts-experts for revealing potential opportunities and needs for decentralized use of geothermal energy under the general name are «Questionnaire on present situation and further needs for the promotion of geothermal energy in European countries» (Table 1). Considering all the presented materials it is necessary to note the most significant blocks of questions for development and the subsequent application геотермии on tourism-recreational objects (Russian – answers Russia; English language – answers Germany).

Table 1. Questionnaire on present situation and further needs for the promotion  
of geothermal energy in European countries [4].

1.4. Geothermal is included in the national energy master plan?	<b>да</b>	<b>но</b>
3.1. There exists a specific geothermal legislation?		<b>нет/но</b>
3.5. Guidelines exist for licensing of geothermal exploitation?		<b>нет/но</b>
3.7. Geothermal licensing is issued by regional authorities?	<b>yes</b>	<b>нет</b>
4.1. Environmental limits\control exist (e.g. For land subsidence, surface	<b>да\yes</b>	

water pollution, aquifer penetration (connection) etc?			
4.4. Environmental benefits of projects must be demonstrated («ecobalance»)?	<b>да\yes</b>		
5.7. Information or demonstration centers?	<b>да</b>	<b>no</b>	
6.2. Definition of development goals and selection of priority areas?	<b>yes</b>	<b>да</b>	
6.4. Studies on socio/economic impacts?	<b>yes</b>	<b>да</b>	
11. Marketing matters	>	><	-
11.2 Greenhouses and agriculture?	<b>да</b>	<b>yes</b>	
11.5 Health spas?	<b>да</b>	<b>yes</b>	
11.6 Swimming pools?		<b>да /yes</b>	
11.8 Combined space heating and cooling?	<b>yes</b>	<b>да</b>	
13.4. Demonstration projects (possible)?	<b>да /yes</b>		
13.5. Field development?	<b>да</b>	<b>yes</b>	
The note:>many;> <in some degree; - is not present			

Equipment by geothermal system of tourism-recreational zones practically probably. For the socially-rehabilitation purposes application geothermic is most preferably, in a kind of 100 % of ecological safety. Absence of the legislation in this area (attitudes of the consumer and the manufacturer are not established, supervising principles of mutual relations of local authorities and the manufacturer and other are not established.) is a principal cause braking process of penetration on geothermic the market of power. To 2020 Germany plans 20 % energy supply due to renewing energy sources, and Russia only 2%.

Conclusions:

- One of the basic scientific and technical problems is: creation of the equipment and constructions of geothermal installation of a binary cycle; system engineering of a geothermal heat supply on the basis of thermal pumps.
- Ecology-economic force. It is necessary to adapt the prices for use of a source of raw materials, depending on what long-term consequences arise from their use. Introduction of geothermal energy has economic-economic value for many regions of the country.
- Use of geothermal heat as the decentralized source, for development of an infrastructure of local tourism-recreational objects, will allow to unload heating plants partially.
- For objects of tourism, sports and resorts it is necessary to consider positive available foreign experience at the organization heat-and power supply with use of geothermal power. Development geothermic will be possible if projects of complexes will possess sufficient financial and economic appeal. Therefore application of geothermal systems on tourism-recreational zones is the most preferable at a stage of development geothermic.
- Informing of the public on advantages and advantages geothermic is necessary for carrying out at the organization of public discussion of projects with use of information technologies and virtual imitating 3D and 4D models, schemes of use and equipment by tourism-recreational zones geothermal stations.

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