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Geothermal resources and energy complex use in Russia

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Geothermal energy use is the perspective way to clean sustainable development of the world. Russia has rich high and low temperature geothermal resources and makes good steps in their use.
In Russia the geothermal resources are used predominantly for heat supply both heating of several cities and settlements on Northern Caucasus and Kamchatka with a total number of the population 500000. Besides in some regions of country the deep heat is used for greenhouses of common area 465000 m2. Most active the hydrothermal resources are used in Krasnodar territory, Dagestan and on Kamchatka. The approximately half of extracted resources is applied for heat supply of habitation and industrial puttings, third - to a heating of greenhouses, and about 13 % - for industrial processes. Besides the thermal waters are used approximately on 150 health resorts and 40 factories on bottling mineral water.
The most perspective direction of usage of low temperature geothermal resources is the use of heat pumps. This way is optimal for many regions of Russia - in its European part, on Ural and others.
The electricity is generated by some geothermal power plants (GeoPP) only in the Kamchatka Peninsula and Kuril Islands. At present three stations work in Kamchatka: Pauzhetka GeoPP (11MW e installed capacity) and two Severo-Mutnovka GeoPP (12 and 50 MWe). Moreover, another GeoPP of 100 MVe is now under preparation in the same place. Two small GeoPP are in operation in Kuril's Kunashir Isl, and Iturup Isl, with installed capacity of 2, MWe and 6 MWe respectively.
There are two possible uses of geothermal resources depending on structure and properties of thermal waters: heat/power and mineral extraction.
The heat/power direction is preferable for low mineralized waters when valuable components in industrial concentration are absent, and the general mineralization does not interfere with normal operation of system.
When high potential geothermal waters are characterized by the high mineralization and propensity for scaling, the extraction of mineral components should be considered.
The mineral-extraction direction is basic for geothermal waters, containing valuable components in industrial quantities. Thus, the ability to extract minerals is dependent upon the use and maturity of recovery technologies. For such waters the heat is an added product, which use can raise efficiency of basic mineral production processes and even to save fuel. The process of extraction of valuable components should be dominant in such systems.
The most significant deposits of thermal waters represent the brines containing from 35 up to 400 and more g/l of salts. They are mineral raw materials for many chemical elements. Many brines can become deposits of valuable chemical elements: cesium, boron, strontium, tantalum, magnesium, calcium, tungsten, etc. Basically it is possible to recover iodine, bromine, boron, chloride salts of ammonium, potassium, sodium, calcium and magnesium from natural solutions using inexpensive technological solutions. Extraction of other chemical elements is complicated due to high cost of technology. There is a perspective method of ion-exchange pitches for selective extraction of certain components from natural waters. In a basis of the method there is the principle of selective sorption of ions of useful elements or their complexes in solutions with special compounds.
Works of some scientific institutes in Russia strive to create the procedures of chemical processing of hydrothermal minerals to expand the spheres of its economic application.
Many laboratory and natural tests on extraction of valuable components from thermal waters confirm the necessity and an opportunity of complex use of this nonconventional raw material.
It is planned to recover I, Br, KCl, CaCl, NaCl from brines in Yaroslavl area. New methods of mineral and valuable elements extraction from industrial solutions are developed on the basis of biosorbent use.