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Multipurpose Utilization of the Geothermal Resources in Crimea

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ABSTRACT

The increasing of economic efficiency of industrial utilization of thermal waters primarily calls for the adoption of available advanced technologies, apart from heat extraction, the recovery of useful components the waters contain: natural gas, iodine, bromine, etc. This situation stimulated development of a number of comprehensive technologies and two such technologies have been already put to use in two geothermal demonstration units.

First of the two is focused on the separation of gas from thermal water. The gas is fed to a converted diesel engine that drives an electric generator, while thermal potential of degassed water is used up in a heat-supply network. The technology-based demonstration plant was constructed at Medvedyevska site of Severo-Sivashskyee geothermal field in Crimea. Thermal water of this site has a temperature of 70°C and gas content of 1 M^3 of gas per M^3 of water. The demonstration plant generates 0.8 MW of heat and 60 kW of electricity.

The second technology implies the recovery of iodine and bromine from thermal water prior to directing the latter to a heat-supply system. A baromembrane lab-scale unit based on this technology was constructed at the Crimean Scientific Center of the Institute of Engineering Thermophysics of the NAS of Ukraine.

1. INTRODUCTION

One of the principal causes of the slowed down development of geothermal power in Ukraine is the low economic efficiency of corresponding projects, in particular, the high calculated deadlines of investments's payback.

Rather low tariffs for the electric power and heat, which are the component part of the state economic policy of Ukraine, make practically impossible the development and realization of the profitable projects in the field of geothermal power.

In such conditions the increase of economic efficiency of such projects can be achieved only by complex use of all resources of the geothermal carrier.

It is obvious, that besides a power component, the important resources are:

-gas component of geothermal water,

-mineral components (iodine, bromine, rare and rare-ground metals) and water (at least for technical applications).

The presence of a significant amount of the dissolved natural gas (mainly the methane with the gas factor not less than 1 m^3 on 1 m^3 water) in thermal water does the development of the various types of heat- and -electric - utilizing technologies economically expedient. One of the variants of such technology can be the plant containing a separator with gravitational division of liquid and gas phases.

After the isolation of a gas component, the thermal water moves in a heat-power-driven block, which consists of hydrocyclone, geothermal heat exchanger and force-pump. These parts were connected consistently.

The isolated natural gas moves on the electromechanical block in which is the diesel gas engine with the electrogenerator.

The technologies of the complex utilization of power- and gas- component of geothermal water are characterized by high technical and economic parameters. The cost of producing electric power and heat is below the corresponding tariffs.

The specific capital investments for a power unit are not great and do not exceed $100/KV for the electromechanical block, and $80/KV for heat-power-driven block, taking into consideration the construction of thermal networks. The term of payback of capital investments do not exceed 3 years.

Along with the utilization of heat and gas components of geothermal water, the parallel development of technologies for isolation of valuable mineral components promotes to increase the economic efficiency. The technologies of utilization of such components of geothermal water as iodine, bromine, rare and rare-ground metals (lithium, strontium, rubidium and others) are developed. The expediency of realization of such technologies should be defined particularly for each geothermal field and represents a separate concrete technical - economical problem.

Another way to increase the economic efficiency of geothermal fields is perspective use of water, in particular, during the development of such technologies in regions with deficiency of water. It is possible to apply the mentioned approach during an obligatory estimation of ecological, economical and technical components of the problem.

2. CONCLUSION

As the return pumping of the geothermal water is practically obligatory condition of ecological safety of the objects, including the maintenance of a renewable resource of water, it is necessary to realize all-round study and a quantitative estimation of volumes of water which can be used.

From the economic point of view it is necessary to have the relative estimation of costs for preliminary clearing of the

used volumes of water (at least for the technical purposes, for example watering in agrotechnology) and power expenses for return pumping.

Using the modern profitable chemical- and bio-technologies of preliminary clearing of a part of geothermal water, the profitability of its use exceeds the costs of return pumping.

So, the complex use of all resources of the geothermal carrier allows to raise considerably economic efficiency of its industrial use.