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Geothermal Resources of Republic Daghestan

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ABSTRACT

Daghestan is a unique geothermal province, where local zones are widely distributed with abnormal high stratal pressure and temperatures. The territory of Daghestan surpasses all known sedimentary basins of the CIS in thermal intensity of bowels, except Kamchatka and Kuriles. Temperatures at depths of 3-6 km here are 140-210 ^{0}C, that 80-100 ^{0}C is higher than in Azerbaijan, the Astrakhan and Rostov regions, 40-60 ^{0}C is higher than in next Turkmenistan, Kazakhstan and the Stavropol crest, 90-120 ^{0}C is higher than in Tatarstan and Southern Ural /1/.

Principal cause of high thermal intensity of a sedimentary mantle of Daghestan is presence in its section of thick aquifers distributing to the big depths. Thus the highest temperatures are marked in Terek - Kuma and Terek - Sulak depressions - fields Tarumovka, Jubilejnyj, Sukhokumsk, Kizlyar, Babajurt, Achi-Su, Tarki, Thernair.

Productive horizons are presented by dolomite limestone of Triassic neftekumsk suite and Jurassic and Lower Cretaceous sandstone. Their thicknesses vary from 100 up to 400 m at depth of bedding 3800-5200 m. Here there are maximal output of wells (90 l/s), high stratal temperatures (190 ^{0}C) and pressures (60 MPa), and the highest in Northern Caucasus resources of low-salt heat power waters (80-100 ^{0}C). In a southern part of Daghestan where water-bearing complexes are spread in the top zone, temperatures at depths 3-5 km are approximately 40-50 ^{0}C lower than in Northern Daghestan.

As one can see, Daghestan has huge geothermal potential. Specific thermal resources of separate thermal abnormal zones achieve 120-140 GJ/m^2, and the area of such zones is 140-150 km^2. The given fact in a combination with presence in sedimentary thickness of thick high-permeable strata and a large number of existing wells allow to realize in Daghestan the integrated systems of geothermal heat supply and geothermal power plants with capacity of hundreds megawatt

1. GEOTHERMAL DEPOSITS OF REPUBLIC OF DAGHESTAN

The most extensive reserves of geothermal waters with temperature from 40 up to 180 ^{0}C and mineralization 1.5 - 210 g/l are concentrated in Northern Daghestan /2-3/. Starting since 60th of the last century here it was found ten large deposits, drilled and prepared for operation more than hundred thermal wells. Now in operational fund of JSC "Geotermneftegas" there are 123 wells, from which 45 - working, 19 - observation and 59 - idle, pending the consumer. In 2008 extraction of heat power waters was carried out in seven thermal water intakes: Makhachkala, Thernair, Manas, Izberbash, Kajakent, Kizlyar, Kordonovka. Development of deposits conducts according to available licenses and the technological modes are coordinated with Ministry for Protection of the Environment and Natural Resources RD and the Daghestan mine technical inspection.

In respect to deposits the situation looks as follows.

1.1 The field Makhachkala - Thernair

It is situated within the limits of Makhachkala city, it is related to Makhachkala anticlinal fold and its northwest periclinal end.

Industrial thermal water abundance of the deposit is related to sediments of Middle Miocene age, in which there are water bearing sandy layers of suites "А+Б" and "В" of chockrak horizon, and also the I-st and II-nd sandy members of karagan. On geological conditions it concerns to deposits of stratal type with rather simple hydro-geological conditions that is expressed by consistency on thickness and lithological structure of water-bearing beds, insignificant variability of filtration properties through the field, a constancy of hydrogeothermal and hydrochemical conditions. In northwest periclinal parts of the fold (Thernair water intake) in sediments of suite "В" of chockrak horizon new thermal water-bearing sandy leyers occur, which are not present in the central part of the fold. Now development of the deposit is carried out by two thermal water intakes: Makhachkala, located within the limits of Makhachkala city and Thernair, located within the limits of northwest administrative-planning area.

1.2 The Mackhachkala thermal water intake

The fund of operational wells of Makhachkala thermal water intake includes 32 wells, from which: 15 -producing, 6 - observation, 2 - in idle time, 2 – pending recovery and 7 - pending repair. Within the limits of described thermal water intake there are also 31 abandoned wells.

The first sandy member of karagan horizon is developed since 1962 by three wells (24т, 25т, 26т), production outputs 80-545 m^3/day, temperature of water on a mouth 52-60 ^{0}C, mineralization 4.7-5.06 g/l, pressure 0.3 - 0.44 MPa, annual extraction from a stratum is 275575 m^3.

The second sandy member of karagan horizon is developed since 1951 by two wells (160,180), production output 65-130 m^3/day, temperature of water on a mouth 54-59 ^{0}C, mineralization 3.7 - 9.7 g/l, pressure 0.48 - 0.14 MPa. Annual extraction from a stratum is 71175 m^3, and as a whole from karagan aquifer - 346750 m^3.

Suite "А+Б" of chockrak horizon, which is developed since 1966 is equipped by six wells (20т, 30, 36, 37, 63, 97). Production outputs are up to 4-200 m^3/day, temperature on

a mouth 38-53 ^{0}C, mineralization 6.42 - 8.05 g/l, pressure upon a mouth 0.12 - 0.48 MPa. Annual extraction from the suite is 164250 m^3.

The suite "B" of chockrak horizon is developed since 1966 by four wells (83, 29т, 175, 224). Production outputs are 7-80 m^3/day, temperatures on mouths 42-58 ^{0}C, mineralization 2.25-4.32 g/l, pressure 0.07 - 0.32 MPa. Annual extraction from the suite "B" is 57305 m^3.

Annual extraction from Makhachkala water intake is 568305 m^3.

Makhachkala thermal water intake works by flowing regime, development is conducted continuously. The basic part of extracted geothermal water is used on hot water supply, the insignificant part goes for heating and for bottling of mineral water (29т, 83, 175) and also on balneology (30, 97).

1.3 The Thernair thermal water intake

It is located in a northwest part of Makhachkala within the limits of periclinal end of Makhachkala anticlinal fold. Industrial thermal aquifer is confined here to the same sediments as Makhachkala thermal water intake and to sandy suites "B_2" and "B_3" of chockrak horizon, which here under conditions of immersing fold are deposited more deeply.

The basic productive horizon is the suite "B_2"of chockrak sediments. Under conditions of periclinal end of Makhachkala anticline this suite has undergone by significant changes due to increase of sandiness and occurrences of three sand interbeds, which are numbered from the top downward as "B_1", "B_2", "B_3". The most productive suite is "B_2", the maximal daily outputs from horizon achieve 1350 m^3. Suite "B^2" is equipped by two wells (27т, 38т), temperature of water on wellheads of these wells are 98-101 ^{0}C, mineralization 20.7 g/l, pressure 0.8 - 1 MPa. Annual extraction from interbed "B^2" is 252900 m^3 of thermal water.

Suite "А+Б" of chockrak horizon is equipped by two wells (12,22), which in cold season provide heating hothouses of state farm "Teplichnyi". Outputs of wells are 300-450 m^3/day, temperatures on mouths 52-53 ^{0}C, mineralization of water 6.3-7.92 g/l, pressure 0.12MPa. In 2008 from the stratum it is taken 124500 m^3 of geothermal water.

Karagan thermal water-bearing horizon is developed since 1962 by two wells (6, 95). Outputs of wells are 270-310 m^3/day, temperatures on mouths 50-54 ^{0}C, mineralization of water 3.38-5.39 g/l. Waters are used for heating of offices of Mahachkala SIA and Administration of "Nefteservis". Annual extraction of the heat-carrier from karagan horizon makes 96280 м^3.

The operational fund consists of 24 wells, from which 6 - production, 3 - observation, 9 - in idle time and 6 - pending abandonment.

Thermal water intake functions since 1975. Intensive development is conducted basically in the winter period. In this period thermal waters give through heat-exchanger for heating of state farm "Teplichnyi", Makhachkala OGPA, Administration of "Nefteservis", and also the big inhabited complex on Aeroport highway.

In the summer period two wells 27т and 28т work only with the reduced outputs of stratal water, due to which the water is warmed up going on hot water supply of multi-stored buildings.

Extraction of heat power waters on Thernair site makes 473696 m^3. As agreed with FSUE "Dagvodresursy", the waters containing harmful components in volume of 2528000 m^3 are disposed into the channel K- 4-11.

1.4 The deposit Manas

It is put into production in 1980 at the request of association "Dagkurortsovet". It is located on a coast of Caspian sea, in limits of Karabudahkent district of the Republic of Daghestan near settlement Manaskent.

In 1966 the prospecting hole 9т has given inflow from karagan sediments deposited at depth 1414-1448 m of medicinal thermomineral water, which now is used for balneology procedures in the sanatorium "Caspij".

According to existing classification of underground waters, water of well 9т concerns to mineral, brine chloride, sodium, iodine-bromine.

Seasonally outputs of thermal water vary from 16 up to 30 m^3/day at temperature 40 ^{0}C, mineralization 59.38 g/l and pressure 0.05 MPa. Annual production of the field makes 10950 m^3, and as a whole on the Central field site - 579255 m^3.

1.5 The deposit Izberbash

The deposit Izberbash of heat power waters is located within the limits of Izberbash town, 65 km southeast from Makhachkala.

As the geological object it is confined to Izberbash anticline. Industrial thermal waters are kept in water-bearing sandy layers of chockrak sediments. Basic productive horizon is the suite "Б", which depending on structural position within the limits of the anticline is deposited at different depths from 870 up to 1550 m.

Modern thermal water intake is submitted by 16 wells, from which 9 are in operation, 3 - observation and 4 - pending the consumer. Thermal water intake works continuously in a flowing regime. Extracted waters are used mainly for hot water supply of the town and in part for bottling medicinal and table mineral water "Azis".

Production outputs of wells make 50 - 500 m^3/day, temperature 40-60 ^{0}C, pressure 0.06 - 0.26 MPa. By the quality the specified waters concern to drinking, medicinal and table, with mineralization 2.04 - 3.19 g/l. Annual output of stratal waters makes 704450 m^3. The used waters as agreed with FSUE "Dagvodresursy" are disposed into the municipal water drain.

1.6 The deposit Kajakent

It is located in limits of settlement Novokajakent of Kajakent district. The water intake is submitted by four wells restored from fund of prospecting oil wells and giving industrial inflows of thermal water.

Wells work under flowing conditions. Reserves of thermal waters are confined to sandy interlayer of the suite "Б" of chockrak horizon. Wells outputs are 50-80 m^3/day, temperatures on mouths 45-59 ^{0}C, superfluous pressure 0.14 – 0.19 MPa.

Chemical compound of waters of all wells is the same and characterized by a weak mineralization (1.9-1.85 g/l), and

hydrocarbon-sulfate sodium structure. Pyatigorsk research Institute of health resort treatment and physiotherapy recommended thermal waters of the Kajakent deposit for drinking use and also for bottling as natural mineral water. They also can be used for various household needs: baths, kindergartens, hot water supply.

Extraction of thermal water from Kajakent thermal water intake is 102200 m^3 and as a whole on the Southern field site, where Kajakent and Izberbash water intakes include - 806605 m^3.

The used waters go into waste channels, from where they are deduced out of limits of settlement and are filtered in sand pebble sediments of Quarternary age.

1.7 The deposit Kizlyar

It is located within the limits of Kizlyar town 160 km to the north from the capital of the republic.

On geological conditions the Kizlyar deposit is related to stratal type with rather simple hydrothermal conditions. Water-bearing horizons are confined to sediments of chockrak and apsheron age. Water containing layers are combined by quartz sandstones (chockrak sediments) and fine-grained, low cemented sands easily collapsing in bottom-hole zone of a well (apsheron sediments). On thickness and lithological structure sandy layers are relatively uniform.

Waters of chockrak horizon are high thermal, superheated (temperature on a mouth of a well 100-104 ^{0}C), that provides thermolift effect. Trial development of the deposit is carried out since October, 1970. Geothermal water from chockrak horizon is used by Municipal Management "Teplovye seti" for heating of a municipal available housing of Kizlyar. To additional charging of the second contour geothermal water from apsheron wells moves.

Since originally explored resources of Kizlyar deposit (for six prospecting wells) were estimated by Institute VNIIgaz 17 thousand m^3/day and did not satisfy perspective requirements of the town for heat (43 thousand m3/day), in 1984 under request of Gosplan of DASSR on Kizlyar field the second stage of prospecting works had begun, which foresaw gain of reserves and simultaneously solved a problem of recycling the used heat-carrier. During realization of prospecting works 21 wells were drilled and unique multilayer geothermal deposit was found. As the basic object of industrial use chockrak aquifer is determined. Now theoretically and practically also the problem of utilization of the waste water is solved by its return to parent layers through specially drilled injection wells.

Resources of heat power waters of Kizlyar deposit of category $C_1 + C_2$ make 26.4 thousand m^3/day that satisfies today's requirements of the town in thermal energy. Modern thermal water intake is presented by 17 wells, from which 7 - producing, 2 - injection, 4 - observation and 4 - in idle time. Development conditions are seasonal, flowing (from October, 15 until April, 15).

Apsheron horizon is equipped by two wells (6т, 9т). Thermal water is used in the second contour of heating system. By structure this water is hydrocarbonate chloride sodium alkaline reaction, the mineralization 1.89-2.14 g/l, contains the increased quantity of humus. Production output of wells are 1000 m^3/day, temperature on a mouth 46 ^{0}C, pressure 0.35 MPa. Annual extraction from apsheron horizon makes 362000 m^3.

Chockrak water-bearing horizon is equipped by five wells (1т, 3т, 5т, 17т, 21т), outputs are 2000-1500 m^3/day, temperature on a mouth 101-95 ^{0}C, mineralization 2.1 - 9.2 g/l, superfluous pressure upon mouth 0.8 - 1.4 MPa. The chemical compound of thermal water from chockrak horizon is characterized by chloride sodium structure, alkaline reaction and the content of toxic substances (phenols, aromatic hydrocarbons etc.). It is resulted from this, that safe use of thermal waters of Kizlyar deposit is possible only under the closed circuit and under condition of obligatory realization of the used heat-carrier injections.

This condition today is carried out in part. So, if on thermal points of Kizlyar in 2008 it was given 1360800 m^3 of thermal water, in underground horizons it is returned 795800 m^3. Other part of it, as agreed with FSA "Dagvodresursy", has gone to disposal to drainage channels Kizlyar - Caspian and K-6. Totally for one year from Kizlyar deposit it is extracted 1722400 m^3 of thermal waters.

1.8 The deposit Kordonovka

It is located 10 km to southeast from Kizlyar within the limits of village Kordonovka.

The water intake is presented by four wells, two of which are equipped on chockrak aquifer (1т, 3т), but stand idle because of absence of consumers. Also the well 2т, equipped on akchagyl horizon for the same reason stands idle. Now the water intake is developed by one well 4т, equipped on apsheron aquifer. The productive horizon is submitted by a fine-grained sandy layer with thickness of 14 m.

Water is characterized as low salt (2.5 g/l), chloride hydrocarbonate sodium with alkaline reaction of medium. Water in therapeutic active concentration contains only bromine, and also various organic substances (64 mg/l), among which prevail humus (57.2 g/l). This water is recommended by Pyatigorsk scientific research institute of healthy resort treatment and physiotherapy for treatment diseases of the supporting-motor system, peripheral nervous system, cardiovascular system, integuments and female illnesses.

On the basis of the well 4т the collective-farm bathhouse functions, also bottling medicinal and table water is organized, which is in great demand. Output of the well is 25 m^3/day, temperature on the mouth 40 ^{0}C, mineralization 2.18 g/l, superfluous pressure 0.6 MPa. Annual production of water makes 9125 m^3. Disposal is carried out into the drainage channel.

Annual extraction of thermal waters of the Northern field site, into which structure enter the Kizlyar and Kordonovka water intakes, makes 1731125 m^3.

In total on republic in 2008 it is extracted and realized 3591000 m^3 of thermal waters, and for six months of the current year - 1947507 m^3.

High outlook of the deposits listed here for heat supply and manufacture of the electric power does not cause doubts and proves to be true a quantitative estimation of geothermal potential of Daghestan, which at flowing conditions of operation makes 800 thousand m^3 /day that is equivalent by 10 million GCal.

Thus the big reserve for expansion of use of geothermal waters deposits are, which reserves are already explored, but are not used. There are 18 such deposits in Daghestan or 2/3 from total. The principal cause of this fact consists of insufficiency of the funds, allocated for prospecting works, low tariffs for thermal energy and full absence of investments for realization of high profitable geothermal projects.

The analysis of above-stated allows to note the obvious break existing in a scientific substantiation of geothermal power production and an innovational susceptibility of the subbranch /4-6/, potential opportunities and an existing condition of use.

In our opinion, the given situation has in the basis two main reasons:

1. Incomprehension of a role of geothermal power system by the organizations responsible for its development. Grants, tax privileges and other stimulating factors for each megawatt of the installed capacity all over the world are stipulated. The given system in this or that kind exists both in USA and Japan, and in Nicaragua and Ethiopia. There is no it only in Russia.

2. Absence of breaking through projects in the geothermal power engineering, which have incorporated last achievements of the ajacent industries and capable to duplicating.

The solution of the first problem is out of frameworks of the report, though it is very important.

We shall consider three projects, in our opinion, capable to solve the second problem

2. POSSIBLE PROJECTS OF COOPERATION WITH GEOFUND

2.1 Reconstruction of system of geothermal heat supply of Kizlyar town

The town of Kizljar being a regional administrative centre of Daghestan, is located in its northern part on both sides of the river Old Terek. Distance from Makhachkala is 221 km. Leading branches of economy, in which it is occupied almost 85 % of the population - mechanical engineering and the food-processing industry. The richest geothermal resources and a favorable transport and geographical position create preconditions for the further development of the town, as populated area.

Now Kizlyar is before large changes, which are expected in all spheres of its economic life, and including in the sphere of development of municipal economy. Today in the town questions of heat and hot water supply of apartment houses, and also the enterprises of public and cultural purpose are most sharp. First of all, it is caused by absence in the town of the centralized system of hot water supply, deficiency of drinking water and extremely poor quality of heat supply from existing geothermal HDS. Therefore, practically all parts of the town system of heat supply require radical renovation, beginning from thermal distribution stations, heat pipelines and finishing user's inputs.

Now works on calculation of reserves of the Kizlyar deposit still continue and there are some grounds to assume that reserves of the deposit will be reconsidered, i. e. they can not correspond to earlier executed estimations (10.7-26.4 thousand m^3/day). In case that reserves will be estimated about 43-45 thousand m^3/day the real opportunity to return to a question of conversion of Kizlyar in "smokeless" town is represented again. As it is known, in such statement this question stands many years and its legitimacy is not denied until now. Certainly, to speak about conversion in "smokeless" all the town of Kizlyar it would be not real, as along with housing sector there are the industrial enterprises consuming heat of higher potential.

So that in Kizlyar geothermal energy became the basic energy carrier, the nearest years it is necessary to carry out full reconstruction of working system of heat supply, which here works since 1970. In this case it is provided for maximal use of automated management system that will allow to raise quality of heat supply and to lower the specific flow rate of geothermal water. A number of the principles stated in the report and conclusions are general and can be used for designing systems of geothermal heat supply in other similar areas of the country. Others ones were earlier covered in the known literature /3, 4/.

Demand for geothermal heat in Kizlyar steadily grows also the requirement in it makes about 350 thousand Gcal, at actual realization 47-54 thousand Gcal. By available calculations, introduction of the project will allow to receive in addition 210 thousand Gcal of thermal energy, that is quite enough for 100 per cent covering of need in heat and hot water of a municipal available housing and 70 per cent of the industrial enterprises.

The total volume of the investments required for realization of the given project is 19.5 million USD.

2.2 Non-polluting heat supply of Makhachkala on the basis of Thernair water intake

Presence of deposits of geothermal water creates a competition for traditional sources of heat supply, and in some cases for water- and electric power supply. In this case the question of a choice of an energy source is solved by the price factor. Competitiveness of geothermal heat in relation to heat developed in boiler-houses is high enough and sometimes is double or triple of magnitude. In Makhachkala cost of 1Gcal of heat from boiler-houses 1,5 times is higher than from geothermal power stations. In comparison with the boiler-houses working on coal, this ratio is more and reaches 2.5 times. In Makhachkala demand for geothermal energy exceeds supply. Therefore geothermal branch has a problem of commissioning of new capacities, increasing efficiency of geothermal waters utilization.

The purpose of the project is realization of potential opportunities of Thernair thermal water intake by reconstruction of working heat station № 3 and creation on its basis of more powerful Central heat supply point (CHP). The project foresees restoration of pump station of return injection, setting up of gas turbine (GTI) and ozonizer installations, a collector and pumping station. The project is orientated towards the thermal load provided with real demand and interest of administration of the town in development of systems of geothermal heat supply.

As it is seen from the scheme, thermal water with temperature 105 ^{0}C and volume 11600 m^3/day goes first to separators where separation of methane is carried out. The latter after compression under pressure 1.5 MPa goes into GTI. In the summer period the volume of extracted water decreases up to 6100 m^3/day, the amount of separated gas is accordingly reduced also. For maintenance of constancy of operation regime of GTI its nominal capacity is determined according to a summer regime of operation of thermal

water intake, and in the winter period surpluses of gas (11000 m^3/day) go to the peak boiler-house, turned on in especially cold days. Surpluses of gas in the beginning and the end of a cold season come in the system of the gas supplying organizations.

After separation from gas thermal water comes on the 1-st contour of the first level, where through system of plate heat exchangers gives a part of heat (25 ^{0}C) to the second contour supplying the heating system under the diagram 85-60 ^{0}C. The second contour is the closed system and periodically is supplied by fresh water from a water supply owing to inevitable losses of the heat-carrier in heating system. From the first level water with temperature 75 ^{0}C goes to the 1-st contour of the second level, where through system of plate heat exchangers gives heat (25 ^{0}C) to the second contour, through which the heated up fresh water comes to hot water supply. Then thermal water with temperature 50 ^{0}C goes for utilizing and cleaning. In the summer period all extracted water after take-off of heat is utilized through system of injection wells. In the winter period intake capacity of injection wells is insufficient for full utilization of used waters, therefore on disposal after injection pumping-house the ozonizer is installed with throughput of 6-10 thousand m^3/day. Thus, in parent layers 60-65 % of extracted waters are injected and 35-40 % is passed through ozonizers. Use of circulating systems will provide ecological purity of all production cycle.

The approximate volume of the investments required for realization of the Project makes 7.5 million USD, including: for well drilling - 3.8 million USD, for construction of CHP, peak boiler-house and pump stations with system of MIS - 1.06 million USD, for decontaminator, gas distribution and gas turbine stations - 1.79 million USD, ozonizers - 0.46 million USD, recovery of wells - 0.39 million USD.

2.3 The energy-biological complex of the geothermal deposit

The project is elaborated with the purpose of development of thermal and water resources of the standing idle explored deposits, secondary power resources of heat power stations in energy-biological complexes for the expanded manufacture of valuable food stuffs, a protein-vitamin biomass, sturgeons fry and marketable sturgeon. First turn of EBC is created on the basis of Rechninskij geothermal deposit in Kizlyar district of the Republic of Daghestan.

Projected EBC includes the following basic productions:

- fish-breeding pools occupying the area 30 hectares and designed for obtaining 1150 tons of commodity sturgeon for a cycle;

- the algae block occupying the area 20 hectares and designed for obtaining 1500 tons of dry biomass of chlorella and spirulina;

- the geothermal circulating system generally consisting of both producing and injection wells, and stations of return injection. For example, the first turn of EBC includes four wells and one modular GeoES with general annual manufacture 3.5 million kWh of electric power and 233 thousand GJ of thermal energy.

The total commodity output from the basic kinds of constructions and blocks of EBC is determined in the following volumes: sturgeons youth of large weight - 25 million specimens, a balyk of a "red" fish - 570 tons, black caviar - 60 tons, meat of poultry - 1400 tons, tomatoes and cucumbers - 50 thousand centners, biomass of chlorella - 1500 tons.

In comparison with known prototypes of the similar enterprises, which in a cold season use commercial heat, geothermal waters all-the-year-round allow to support optimum temperature regimes in blocks of EBC irrespective of climatic conditions and besides are a fine nutrient medium for cultivation of valuable vitamin forages.

Expected financial results of the project: requirement in investments 16 million USD, profitability of the capital 125 %, profitability to the cost price 220 %, net present value (NPV) - 35 million USD, internal rate of return (IRR) - 27 %, index of profitableness (PI) - 3.2, payment period (PP) - 6 years from the beginning of financing.

For successful realization of the project there are all necessary conditions: the unique by quality and reserves of geothermal waters, ready fund of producing wells, the free ground areas, rather favorable climatic conditions, and also convenient arrangement of thermal water intake and platforms of construction concerning access roads and electric- and water supply. The problem of disposal of the used geothermal waters going from fish-breeding block of EBC here is actually already solved. It can be carried out through the channel of the river Gorodskoi Bank and through a numerous network of irrigation canals, which are practically waterless the most part of the year.

The organizational side of the project does not cause problems. The Rechninskij energy-biological complex will be created on industrial base of the Kizlyar field site of JSC "Geotermneftegaz" and the State poultry farm "Octjabrskij". In territory of the latter already there are necessary buildings and constructions, the free ground areas, and also six geothermal wells prepared for operation.

The project is approved by Administration of Kizlyar district, the State ecological examination of Ministry for Protection of the Environment and Natural Resources RD and independent examination at Goskomarchstroi of RD. After passage of competitive selection in Ministry of Economics it was included as priority one in Federal aim programs "Daghestan - 2001" and "the South of Russia".

CONCLUSIONS

1. Daghestan occupies a key economic-geographical position in the south of Russia, it is its strategically important outpost. The region has significant explored resources of oil and gas, hydraulic and geothermal energy. For promotion of large-scale development of geothermal energy, the most promising part of favorable geothermal and hydro-geological conditions of large thermal water-bearing basin of the multilayer type connected with the Ciscaucasian trough, is on territory of Daghestan.

2. To the present time, the Company "Geotermneftegas" has accumulated large experience of practical use of geothermal waters for water supply of towns. However economical difficulties of recent years with sharp deficiency of investments have resulted in a stoppage of development of geothermal production that has resulted in the fact that the explored reserves of geothermal waters are used only in part. Under these conditions, full modernization and renovation of old technologies is required.

3. The concept of priority utilization of geothermal waters in municipal economy and agriculture, embodied in three

projects offered here, is directed to increase profitableness of geothermal production, to introduction in practice of hi-tech agricultural and biotechnology and integrated geothermal systems, producing thermal and electric energy, and also various valuable food stuffs in energy-biological complexes.

4. The presence of huge resources of thermal waters, a plentiful supply of deposits well explored and prepared for operation, will allow to duplicate any of the offered projects repeatedly at much smaller expense.

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SUMMARIZING MAP OF OIL, GAS AND GEOTHERMAL DEPOSITS OF THE REPUBLIC OF DAGHESTAN

(Made according to information of JSC "Oil Company "Rosneft-Dagneft", LLC "Kaspiygasprom", VNIPIgeotherm and JSC "Geotermneftegaz", 2009)