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Geothermal Energy in Iran Review of Last Three Decades and Future Scope

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ABSTRACT

Despite suitable geological conditions and presence of many potential for geothermal energy productivity in Iran, due to lacking of high-tech instrumentation in the field of drilling, reservoir engineering and power plants construction and also due to existence of huge reservoir of oil and natural gas and cheap expenditures for energy productivity from them Iran is located at the earlier steps of this technique.

On the other hand because of new policies in the government for changing the resources of energy production for domestic demands and also regarding to environmental laws, nowadays it can be seen that several organizations are working for exploration and exploitation of renewable energy resources, Ministry of energy, Center for Renewable Energy Research and Application (CRERA) and Geological Survey of Iran are among the main ones.

The following report is prepared as a summary of recent activities about Geothermal Energy in Iran.

1.PREVIOUS WORKS

Geothermal studies in Iran started in 1975 with a cooperative program between the ministry of energy of Iran and Ente Nazionale per L'Energia Elettrica (ENEL-Italy). Preliminary surveys carried out under this program indicated potential for either geothermal direct-use or power generation in at least four areas in northern Iran, including Khoy-Maku and Mts.Sabalan, Sahand and Damavand (Fig. 1).

2.RECENT ACTIVITIES

Regarding to new policies in the country for energy production from renewable resources, CRERA was established in 1981 with focusing on technology application for wind systems, photovoltaic and solar thermal systems.

From 1995 up to now studies by CRERA showed that 10 promising area could be distinguished all around Iran as can be seen in Fig.2.

Although by caring out of previous work it had been determined that there are two promising geothermal area, Damavand located in central Alborz covering a total area of almost 5500km2 and the other one Maku-Khoy region located in NW of Iran and covering an area about 6500km2 but due to more promising indices and effective factors in second one, main activities focused on the regions in vicinity of Sabalan Volcano and respectively Khoy-Maku geothermal area.

- -Preparation of detailed geological map of Khoy region.
- -Geophysical sampling by aeromagnetic and gravity method in (Sabalan geothermal region).
- -Drilling 7 wells in Khoy and Sabalan region, are the main activities that have carried out by CRERA.
- -Working on industrial cold storage houses project using Khoy geothermal energy resources,

Carbon dioxide production both liquid and dry ice and also electricity production are among the future projects of CRERA.

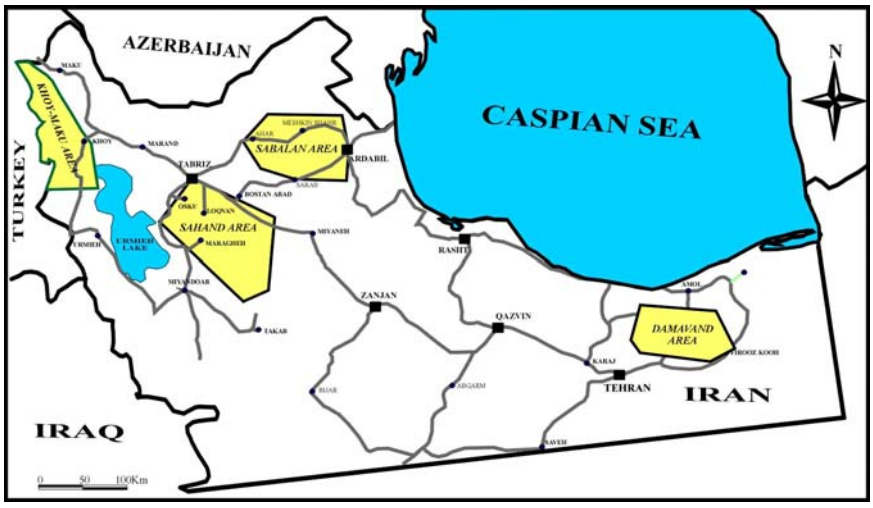

Fig. 1: Four Geothermal Prospects initially identified by ENEL and Terhan Berkeley Co.

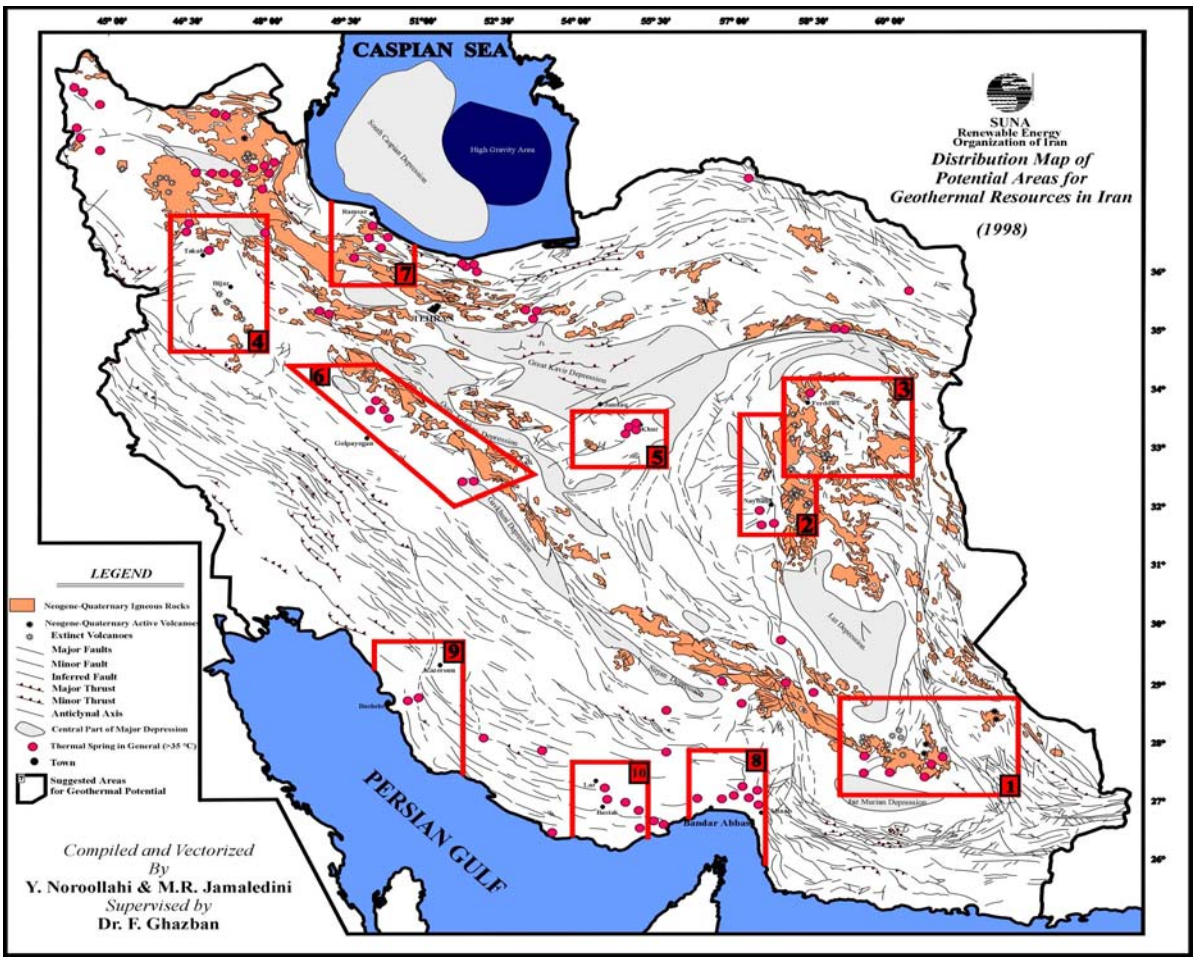

Fig. 2: Promising geothermal area in Iran

Recently increasing interest to attract foreign technical and investment have activated process for two geothermal field as can be regarded following in details:

In 1997 CRERA contracted PNOC-EDC, Philippines to undertake an exploration study of the KHOY region.

An exploration team composed of CRERA and PNOC-EDC personnel completed a program of detailed geological, hydrogeochemical and geophysical surveys at the Qutur Valley in the KHOY region.

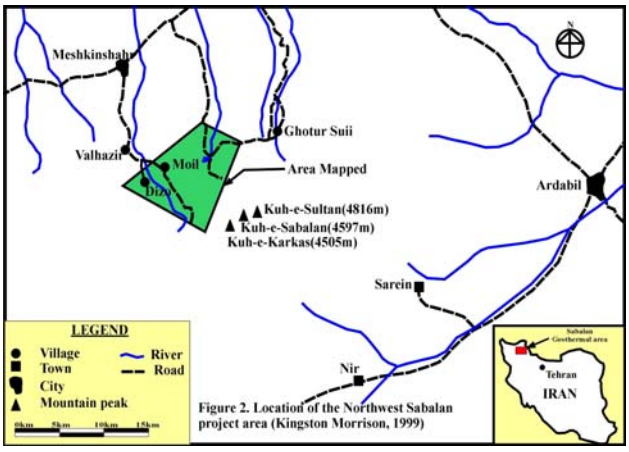

Fig. 3: Meshkin Shahr geothermal field Map.

2.1. KHOY- MAKU

The study covered an area of about 100km2 where the most hydrothermal features are found .From the results of this work it was concluded that despite previous indications of high temp. from chemical geothermometry of hot springs, the geothermal resource at KHOY is probably low grade with reservoir temp. of only 90-120 centigrade and at most 145^0C(Delfin, et al., 1998).

2.2. Mt. Sabalan

In early 1998, the Iran ministry of energy engaged Kingston Morrison Ltd, New Zealand to assist CRERA with detailed surface exploration of the greater Mt. Sabalan area, including the Saraein prospect. Over the following year a comprehensive program was completed consisting of photo and field geology, geochemistry sampling and analysis, an integrated DC/TEM/MT

Resistivity survey (comprised of 212 stations) conducted over an area of 860 km2 (Bromley, et al.,2000) and hydrogeological modeling (Sahabi, et al.,1999; Bogie, et al.,2000).These surveys identified five resistivity anomalies associated with ring fracture intrusives around the periphery of the Sabalan caldera complex, where the Meshkin Shahr prospect on its northwest flanks shows the most promise for favorable geothermal conditions.

Sinclair Knight Merz is continuing to assist CRERA throughout the second phase of work, providing technical support and advice on drilling engineering, well site geology and petrography, well testing, resource assessment and modeling, and engineering feasibility studies.

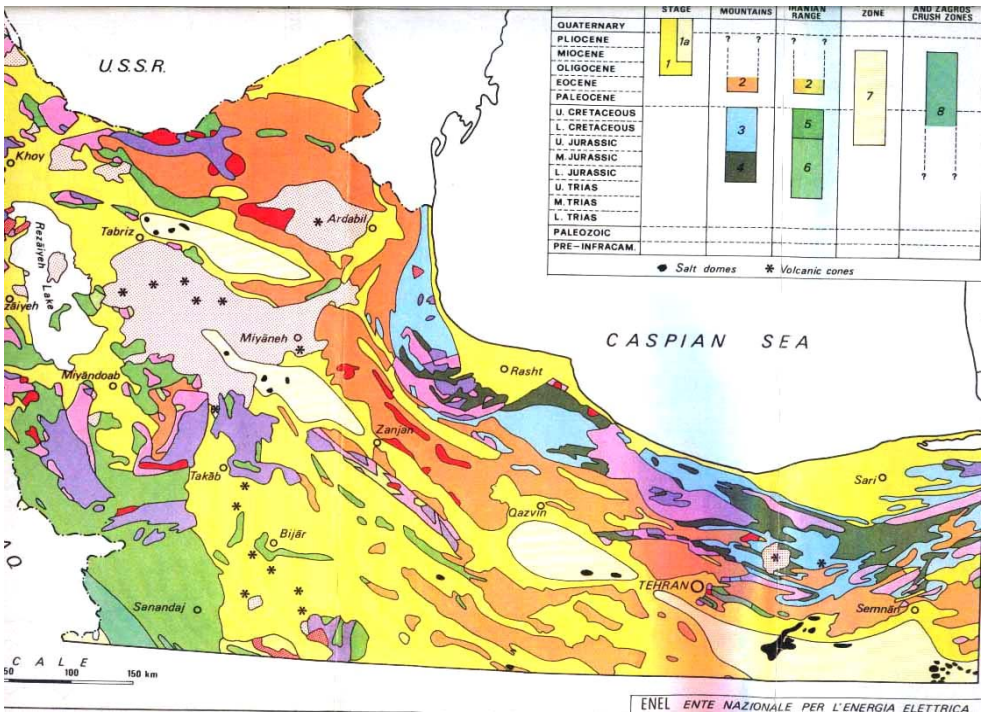

Fig .4: Geological Map of N-NW of Iran.

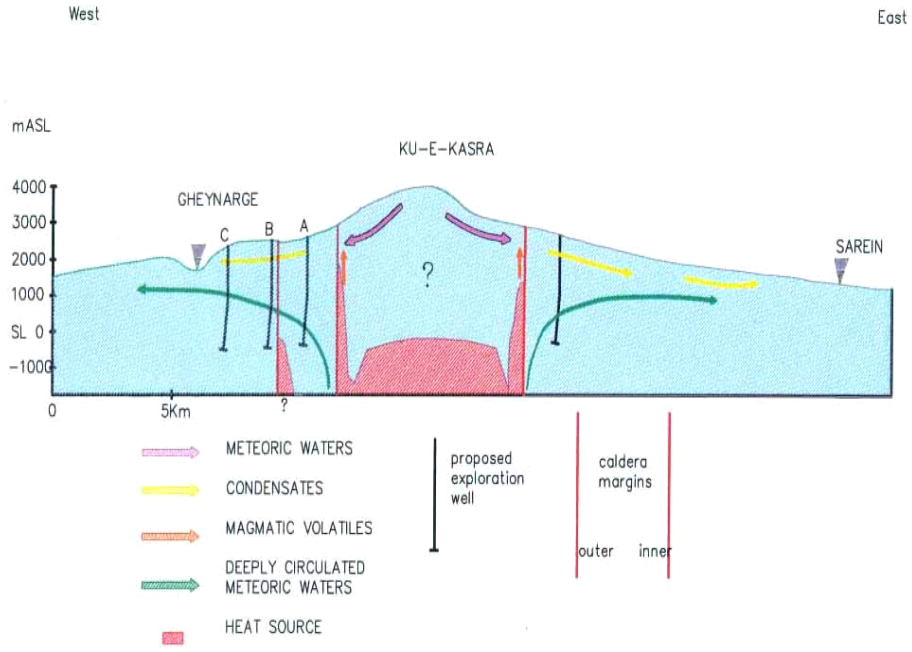

Fig. 5: Hydrogeological model in Sabalan region

2.3. Mt. Saraein

Information from geological and geochemical investigation conducted at saraein in 1996 has been usefully enhanced by data from the Sabalan DC/TEM/MT survey.it is now thought that the numerous hot spring at Saraein result from a lateral outflow of cooling geothermal fluids from the southern sector of the Mt.Sabalan caldera complex.The Saraein geothermal resource has good potential for direct utilization in the form of heating and industrial uses but such developments would have to be carefully balanced against substantial existing uses for bathing, which is the centerpiece of a large local tourism industry.

3. THE FUTURE OF GEOTHERMAL ENERGY IN IRAN

Overall, Iran shows encouraging indications for having several potentially high grade geothermal prospects that may prove suitable for electrical power generation, and a number of lower grade prospects that appear suitable for direct industrial or urban uses. However geothermal energy development in Iran faces some stiff copetition.

Iran has huge reseves of low-cost fossil fules, as the second largest producer of Oil in OPEC, Iran holds nine percent and 15 percent of the world`s oil and gas reserves, respectively.

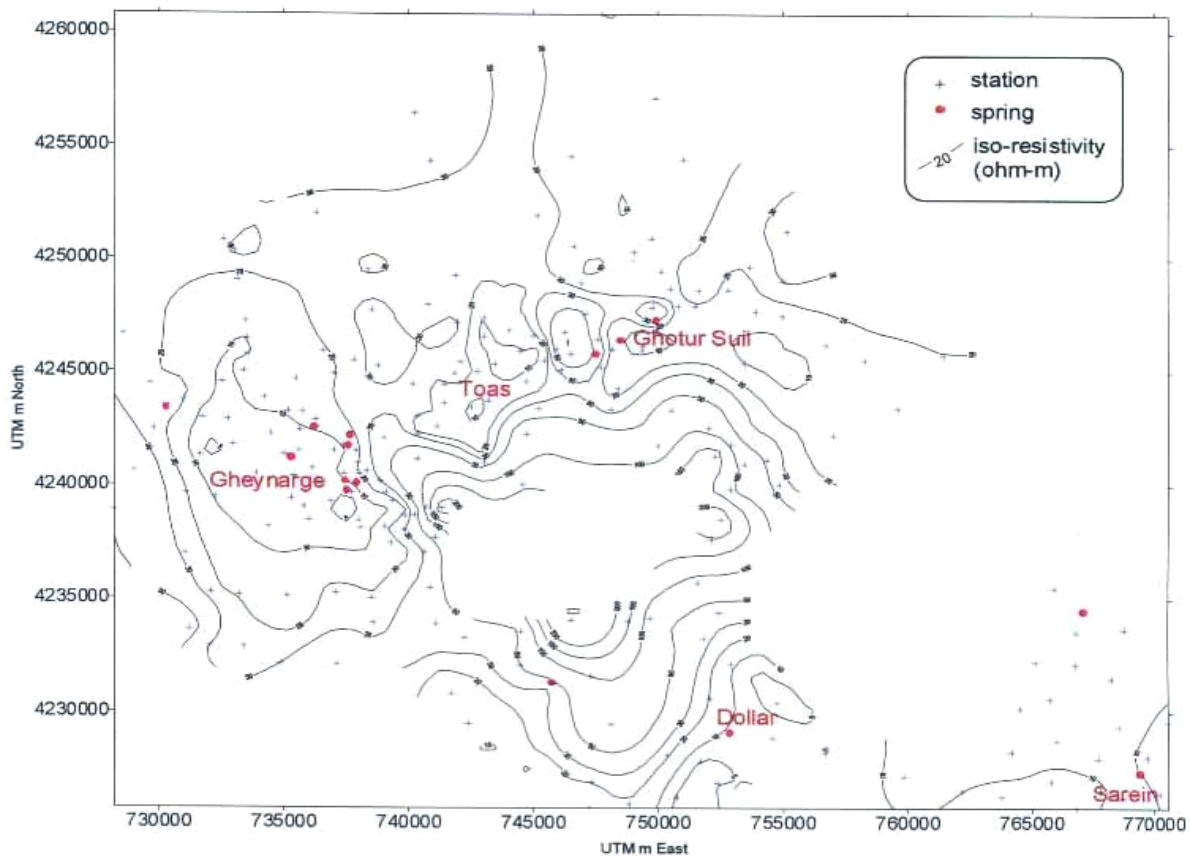

Fig. 6: Electrical Resistivity Anomaly Map for Sabalan region based on MT data assessment.

The country`s national power grid is large, with 29000 megawatts of capacity of which 95% comes from fossil-fuel generation.A further 12000(MW) Of capacity is planned over the 10 next years, with further expansion to an anticipated total of 90000 MW by 2020.

Against this backdrop, geothermal energy will be hard pressed to accieve a significant capacity share of Iran`s overall electricity production mix.Nonetheless,the iranian government`s interest in renewable energy and geothermal resources development is growing strongly, as a way to offset some of the very high reliance of Iran`s internal and export economics on fossil fuels.

Provided that suitable geothermal resources can be located and developed, geothermal resources have an assured future position in the energy sector of Iran even though it is not least cost means for power generation and finally the immediate future of geothermal energy development in Iran is focused on assessing the suitability of the resources so far identified for either electrical power generation and/or industrial use.

Regarding to above mentioned subjects it can be concluded that despite of suitable geological conditions and presence of many potential for geothermal energy productivity, due to lacking of high – tech. instruments in the field of drilling, reservoir engineering and power plant construction Iran is located at the earlier steps of this technique.

4. GEOTHERMAL AND ENVIRONMENTAL GEOLOGY ANDGEOLOGICAL SURVEY OF IRAN (GSI)

GSI has been responsible for basic data preparation to caring out all of the technologies that need to geological information such as geothermal energy productivity, since its establishment on 1959.

Iran is located on the world volcano-seismic belt and because this plateau is affected by several orogenic phases during geological times so there are many indices of hot spring and also a lot of semi and non-active volcanoes.

Preparation geological maps in different scales and accomplishing the systematic exploration research are the main duties of GSI but beside of them giving expertise services in some of the geosciences fields are other parts of the GSI activities.

Nowadays, among the other parts of the world GSI is trying to focus on environmental matters among main duties, so establishment of environmental geology department as a new branching consisting of different expertise manpower (geochemist, geotechnicians, chemical engineers, marine geologist) has accomplished in considering of new policies in GSI.

Mineral activities means exploration and extracting both have caused environmental pollution specially in northern Iran so just now investigation of origin and concentration of heavy metal pollutants and also hazardous waste disposal management are main duties of this new group.

Since energy productivity from geothermal resources should be done with regarding to environmental laws so GSI as a pioneer for doing environmental geology projects will be involved in geothermal fields in near future however GSI has not been responsible directly for geothermal energy productivity, so far.

5. CONCLUSION

Regarding to the increasing rate of urban dwellers and also regarding to the new policies of the government for replacement resources of domestic energy consumption Iran has to utilize renewable energy in near future for compensate of energy demand and also for saving fossil fuels to export, because majority of our incomes comes from crude oil export.

On the other hand environmental agreements force all the countries to use clean energy productivity and preventing of environmental pollution by modifying the old technologies to new environmental sound technologies so, despite a lot of suitable resources for geothermal energy productivity, initial basic data and also many expertise manpower and organizations, due to lacking of high-tech. instruments Iran has not been able to produce energy from these resources yet.

Furthermore Iranian government has shown strong interesting in attraction of foreign investment in last years therefore regarding to good trade relationship between Iran and Japan there are many opportunities for Japanese companies to invest in geothermal field and transform of technology.

Anyway, due to economic, environmental and new policies reasons it seems that energy production from geothermal fields in near future is inevitable so it is hoped that exploration drilling at Mt.Sabalan over the next months will lead directly to a commitment to develop the first geothermal power plant in Iran.

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