Geothermal Direct Uses in Meshkin-Shahr Geothermal Field

Mohsen Taghaddosi, Sohail Porkhial

Renewable Energy Organization of Iran (SUNA), Dadman St, Yadegar-e-emam Ave, Tehran-Iran

Azad University of Karaj

Mo.taghaddosi@gmail.com, porkhial@yahoo.com

Keywords: Geothermal Direct Uses, Meshkin-shahr,

ABSTRACT

Sabalan geothermal field is located close to Sabalan Mountain near Meshkin- Shahr city in Ardebil province in north-west of Iran. The distance of the geothermal field to Meshkin-Shahr city is about 25 kilometers. In Sabalan field, 11 wells had been drilled. The 7 wells are production, 1 well is reinjection and 3 wells are out of reservoir. According to the data from well testing, the mass flow of the wells are 30-70 kg/s and the temperature are 130-170°C. The result of the calculation shows that it will be possible to install 150MWt or 165MWt from these wells. As a first step of feasibility study reports, it will be possible to install district heating systems to heat the houses in the villages that are near Sabalan geothermal field, also installing some greenhouses, swimming pools, fish farms and so on. Two scenarios had been explained for direct uses in Sabalan geothermal field. The first scenario is installing all the direct uses systems near the geothermal field and the second scenario is installing them close to Meshkin-Shahr city far from the geothermal well but close to the main transportation lines and people. In this report, technical studies for the direct use geothermal systems had been collected.

1. INTRODUCTION

Iran has an abundance of fossil fuels in the form of oil and gas. It has the second largest natural gas reserve in the world and also uses oil reserves. In addition to this, Iran has good potential for renewable geothermal, wind, and solar energy that should be used for the benefit of its people. The main benefits of renewable energy use in Iran are:

1. Better overall utilization of its energy sources;

2. Saving fossil fuel for export to other countries or for future generations;

3. These are environmentally benign energy sources, with low CO_2 emissions.

Iran has 14 vast areas with good potential for geothermal utilization, as shown in Figure 1. One such area is the Meshkin-Shahr geothermal field. 10 exploration wells and 1 injection wells had been drilled to determine the parameters of the reservoir and develop the field. 7 exploration wells had been tested and the results shows that it will be possible to have 30 to 35MWe geothermal power plant and have some direct uses geothermal systems with about 150 to 165MWt capacity. But in this report around 20MWt direct uses had been designed as a pilot project, but the preliminary study for direct uses shows that it is possible to install more than 800MWt of some kind of direct uses.

2. THE BASIC INFORMATION IN MESHKIN SHAHR

For the best design of geothermal direct uses systems in **S**abalan field, it is very important to collect the parameters that will **affect** the design. According to the Atec consultant engineers' company reports [4], the basic information of the field had been collected in a circle with the radius of about 20 km that is shows in Figure 2.

In this circle all of the data had been collected include: greenhouses, fish farms, population of the villages, roads, electricity network, gas network, water pipeline network, industrial centers, bullies, sheep and chicken production centers, car washes and so on.

Also topography (Figure 3), humidity data (Figure 4), water resources, the data of the rain and snow and other parameters had been collected and these data had been used in GIS software. [4]
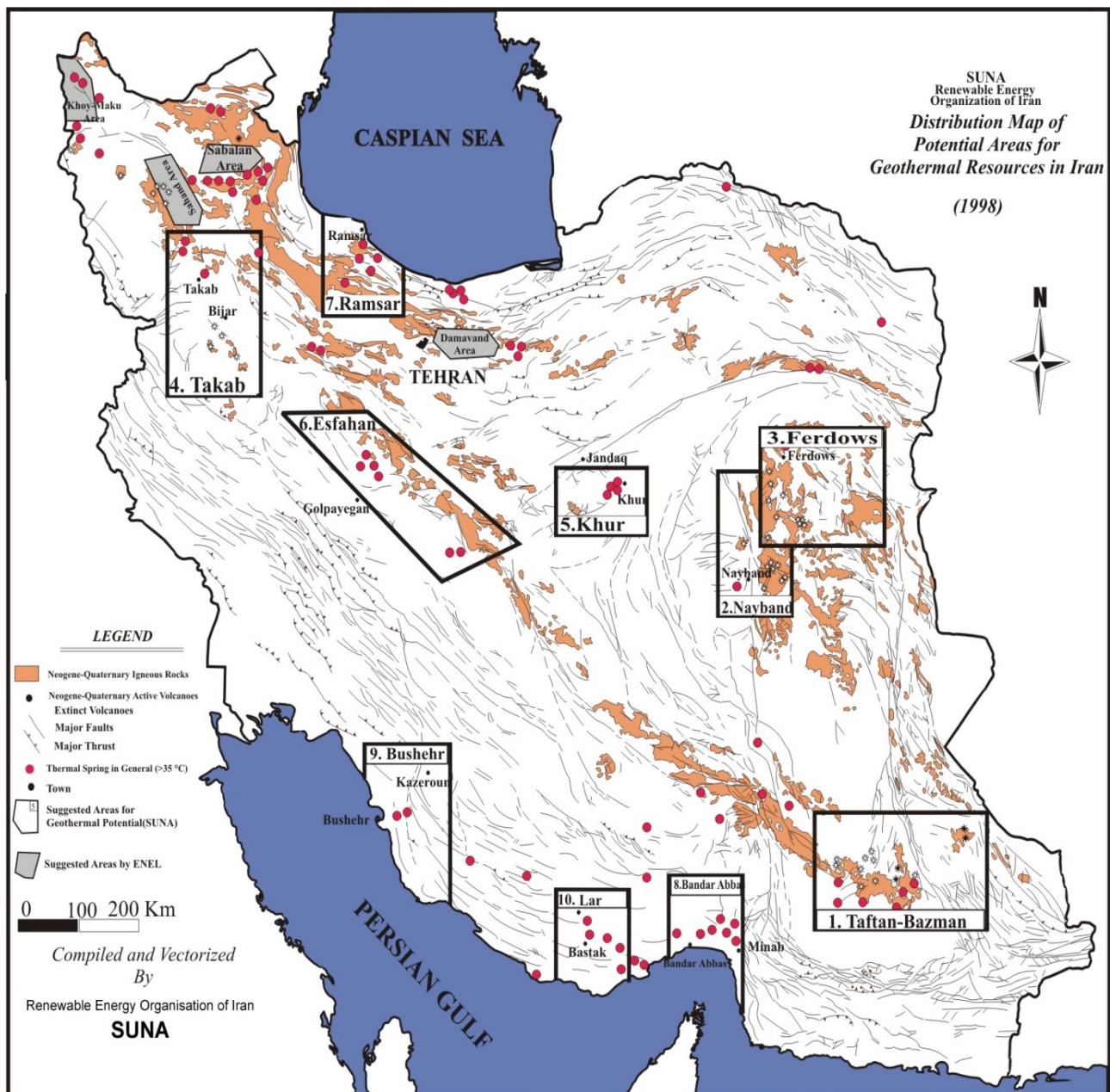
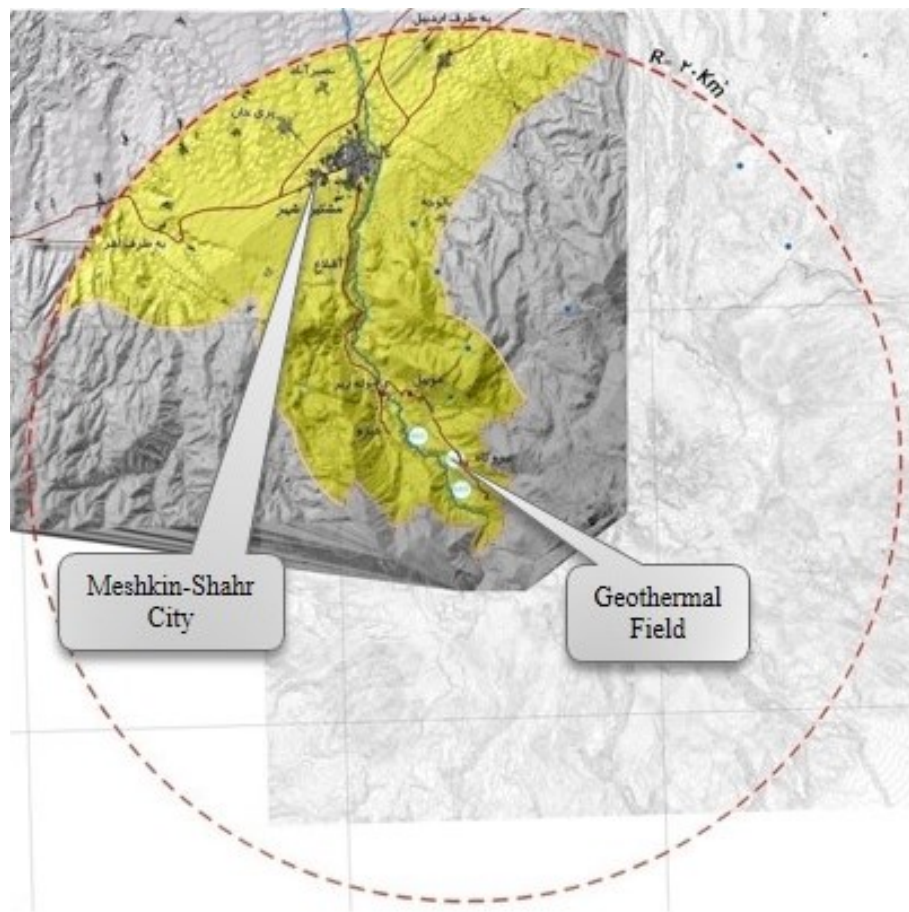**Figure 1: Potential of Geothermal in Iran**

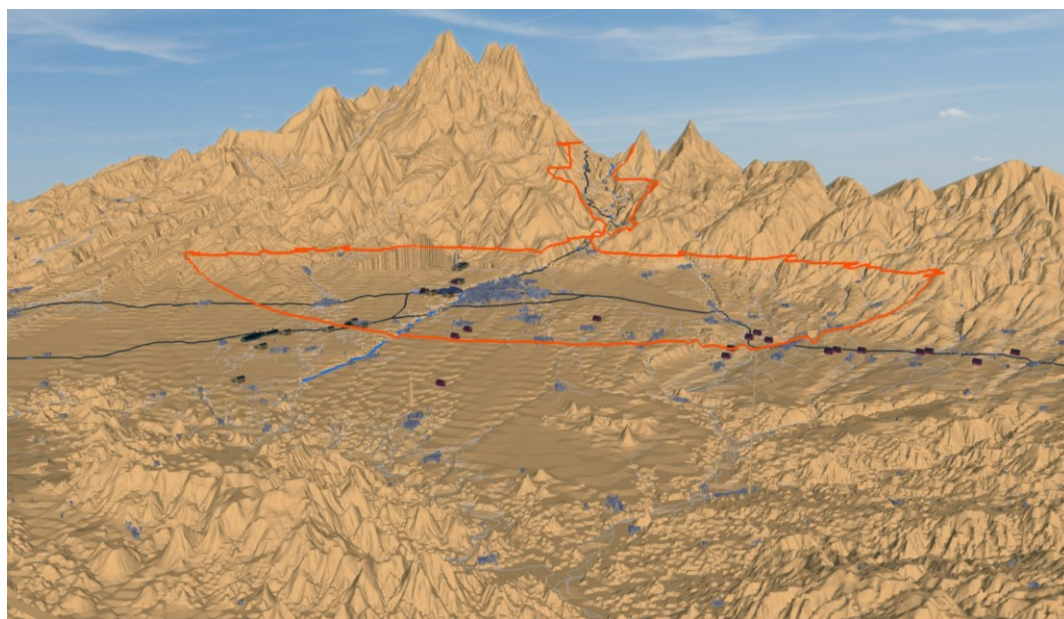**Figure 2: Geothermal field and Meshkin-Shahr city**

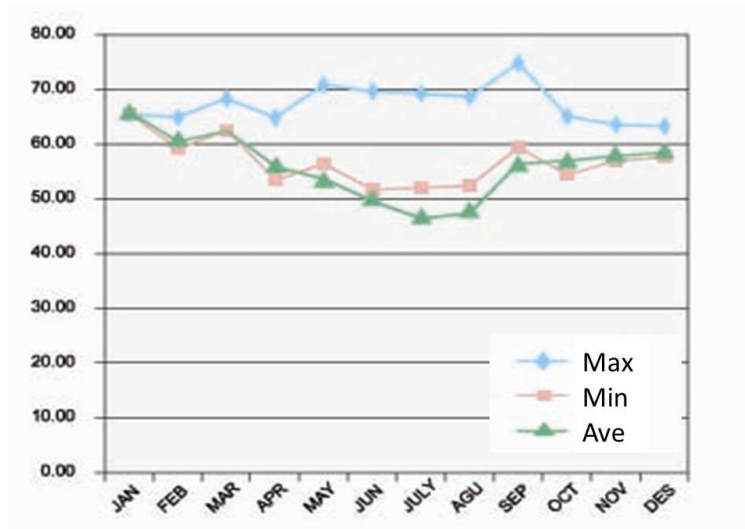**Figure 3: Topography of the geothermal field and Meshkin-Shahr**

Figure 4: The humidity curve in Meshkin-Shahr

3. TWO SENARIOS FOR POSITION

The place of using the geothermal energy and also the position of the direct uses is an important subject for design the geothermal pipeline network. The first scenario is using geothermal energy near the wells and the second scenario is using the geothermal energy near Meshkin-Shahr city. The important parameters in these scenarios are the price of pipeline, pumps, temperature loss, the place of the reinjection wells and other parameters.

3.1 Using Geothermal Energy near Meshkin-Shahr

With two methods geothermal water could be send to Meshkin-Shahr. First method is sending geothermal water to Meshkin-Shahr and use the energy and then pump it to the field and inject it to the injection well, this means the investment cost for two pipelines will be very high and controlling the pressure of the geothermal water in these pipelines will very difficult. [4]

The second method is using the water of Khiyaf-chay River for sending the energy near Meshkin-Shahr and after transferring the heat to the direct uses places pump the water again to the river. These method will need half of the investment cost because one pipeline will be install, but it is higher than the second scenario. [4]
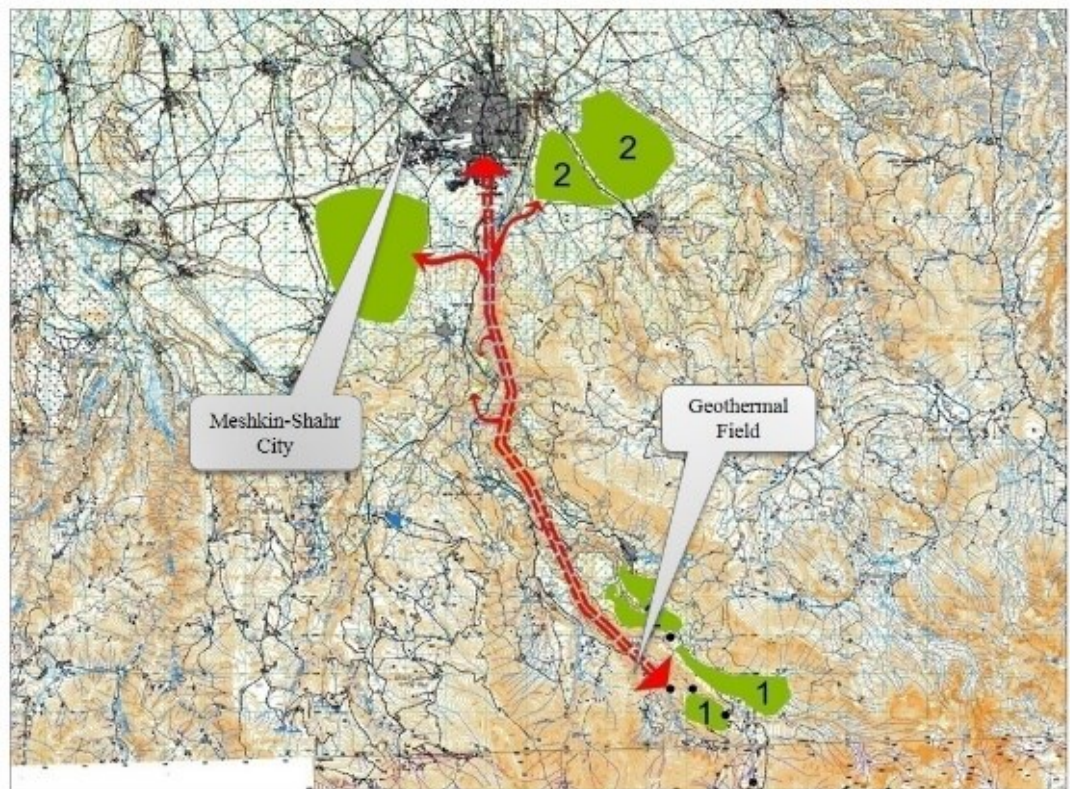

Figure 5: The places that could install some geothermal direct uses

3.2 Using Geothermal Energy near Wells

Using the geothermal water for direct uses near the production wells and power plant is a more economic activity than the first scenario. In this scenario the geothermal hot water comes out of the geothermal power plant is pumped to the direct uses and then injected to the reinjection wells. In Figures 5, 6 and 7 are the places that could install some direct uses. [4]

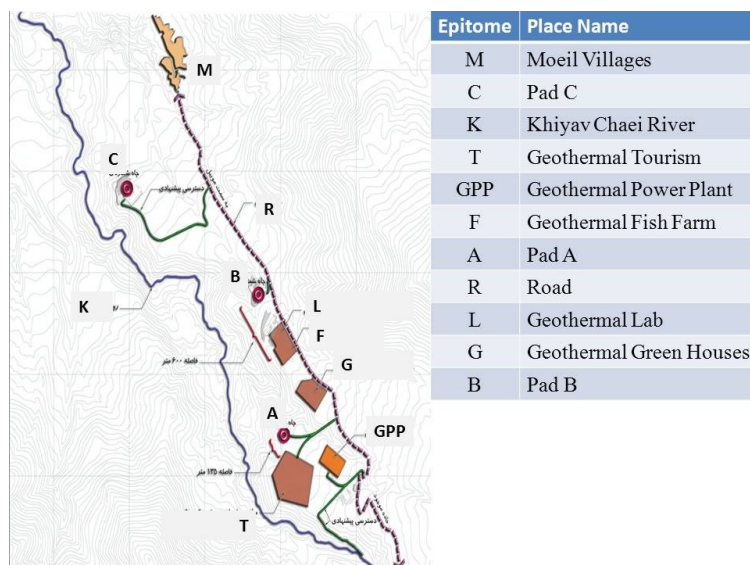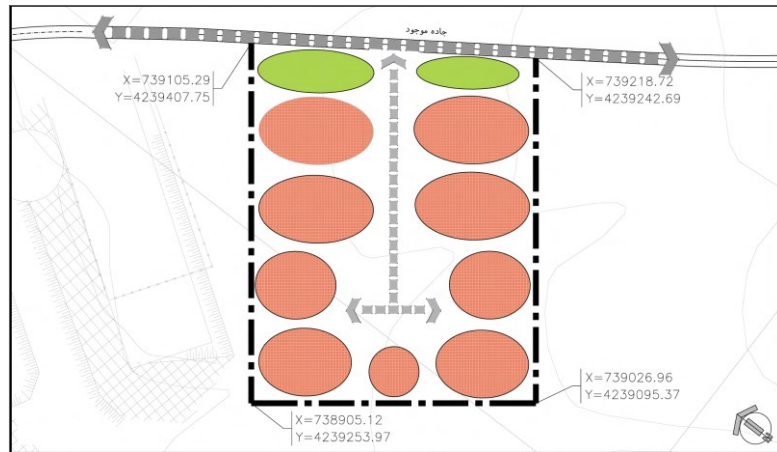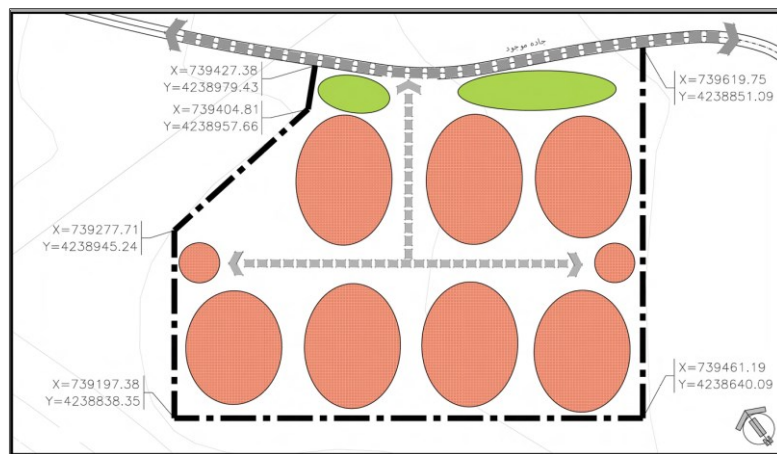**Figure 6: The places that could install geothermal direct use.**

Epitome	Place Name
M	Moeil Villages
C	Pad C
K	Khiyav Chaei River
T	Geothermal Tourism
GPP	Geothermal Power Plant
F	Geothermal Fish Farm
A	Pad A
R	Road
L	Geothermal Lab
G	Geothermal Green Houses
B	Pad B

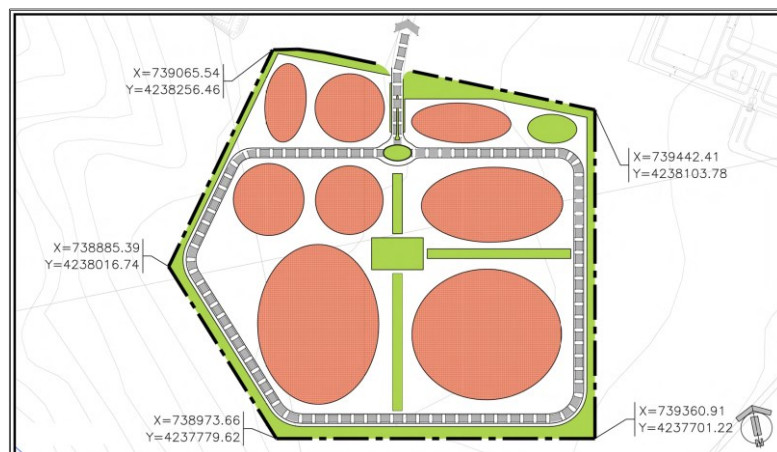**Figure 7: Geothermal direct uses places.**

As the calculation result, in Figures 8, 9, 10 and 11, the information of places for fish farm, greenhouses, tourism complexes and geothermal center unit have been shown. [4]

Figure 8: fish farm place

Figure 9: greenhouses place
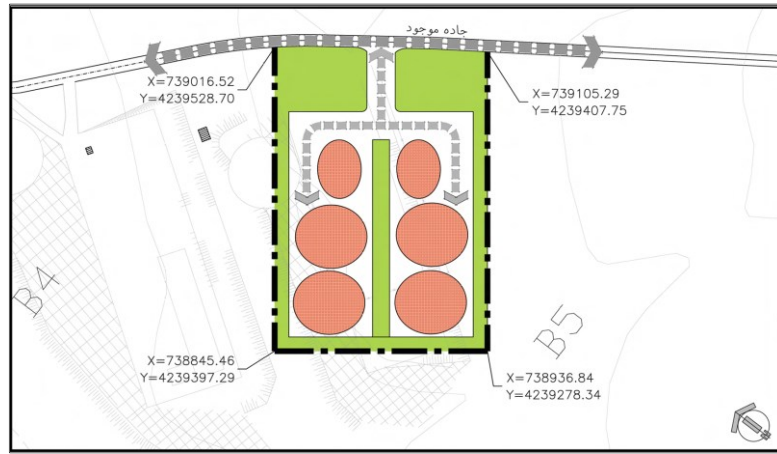

Figure 10: tourism complexes place

Figure 11: geothermal center unit place

According to the Lindal graph[2] and the calculation modeling results with EES software [1], it is better to send the geothermal hot water to the 3 main heat exchangers (H-1, H-4 and H-5). H-4 will be used for geothermal green houses and H-1 and H-5 transfer the heat to the two subsidiaries heat exchangers, H-1 will transfer the heat to the H-2 for heating the power plant station and H-3 transfer the heat to the geothermal Tourism place. Also H-5 transfers the heat to the H-6 and H-7 for heating the geothermal Lab and geothermal Fish farm.[3]
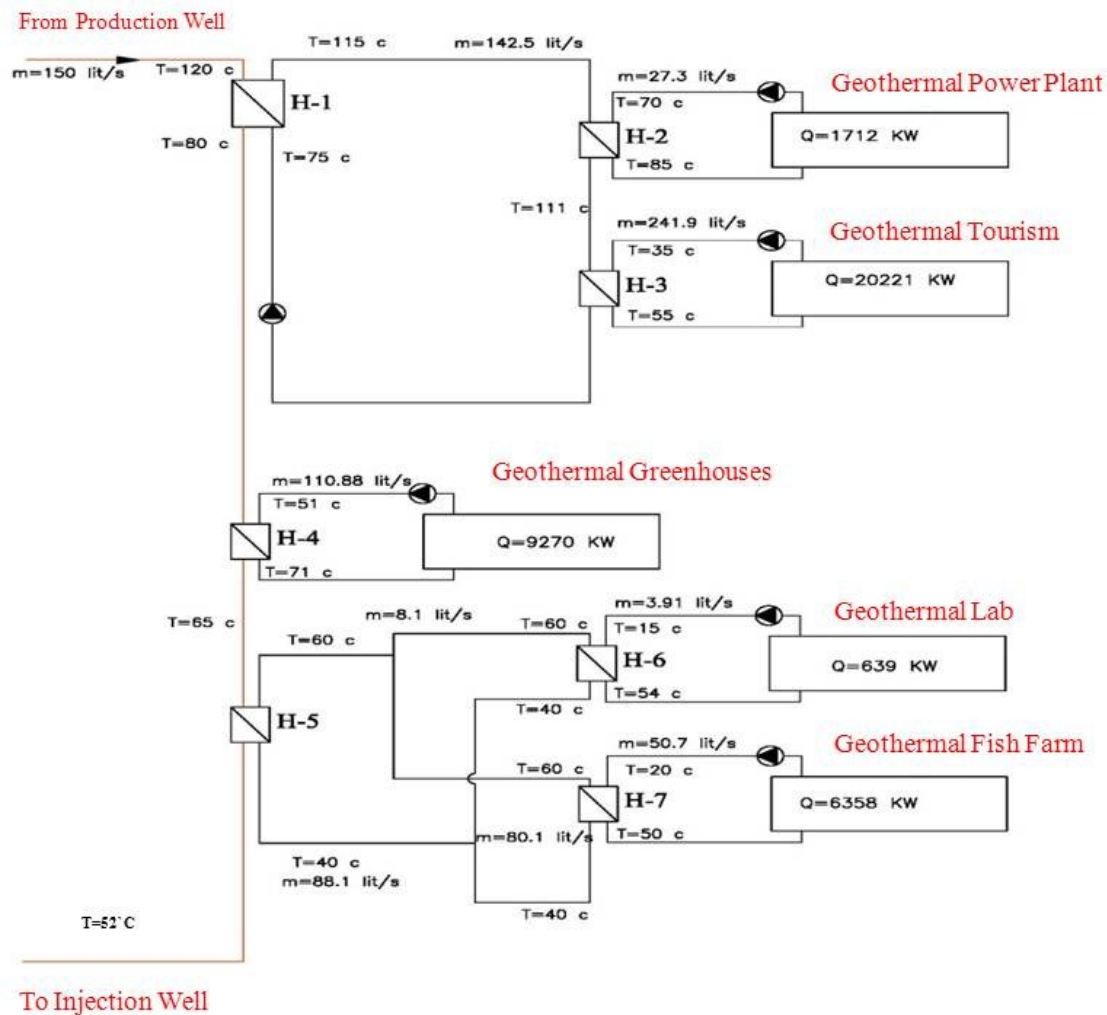

Figure 12: The result of mechanical calculation for GDU

The capacities of these geothermal direct uses have been collected in table 1. [4]

Table 1: The capacity of the geothermal direct uses in Sabalan field

Geothermal Direct Uses	Inlet Temperature (`C)	Outlet Temperature (`C)	Capacity (KWt)	Mass Flow (Lit/s)
Power plant station	85	70	1712	27.3
Green houses	71	51	9270	110.88
Fish Farms	50	20	6358	50.7
Geothermal Lab	54	15	639	3.91
Geothermal Tourism	55	35	2022.1	241.9
Total			20001.1	

5. CONCLUSION

According to the preliminary study about geothermal direct uses in the Sabalan geothermal field, the potential of installing some direct uses is more than 800MWt, but for the first step, it is better to explain a program for installing about 20MWt in the small places that had been shown in the report and then explain the second step, for have some direct uses with full capacity, after the installing of a full capacity (about 200MWe) geothermal power plant.

REFERENCES

1- F-Chart Software, 2003: *EES, Engineering equation solver*. F-Chart Software, internet website, www.fchart.com/ees/ees.shtml

2- Valdimarsson, P., 2003: Lectures on utilization of high-temperature geothermal resources. UNU-GTP,Iceland, unpublished lectures.

3- Wilbur, L.C., 1985: *Handbook of energy systems engineering production and utilization*. John Wiley &

Sons Inc., NY, 1775 pp.

4- ATEC consultant engineers company reports, 2012, in Persian.