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Prospects and Potential in Optimize Utilization of Geothermal Energy in Iran

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Abstract

In the use of geothermal energy is the efficiency of the Earth as a heat source and in all climatic zones has the potential to be used. After studies and surveys conducted in countries explore and exploit the technology owner of the geothermal energy can be seen in this type of system for the combustion of fossil fuels is not used and only heat transfer through the case of geothermal heat pumps are accepts note that despite the evidence suggests the land surface geothermal energy deep within the earth from which you can locate places as potential indicators used. If there are matching the information and data flows in our country with data and information required in this context, conceptual models of potential sites to be prepared. Identify areas for potential layers in different tables for different subjects to be classified. After which the tables given in recognition geothermal energy resources together and have the potential areas are identified. Finally after the implementation of these important cases were seen in the 16 region are potential heat energy. The main goal of this paper is to determine areas where the geothermal energy potential and exploiting it are in Iran.

Key words: renewable resource, geothermal energy, heat pump, generating electricity.

1. Introduction

Most of planners use independent thermal systems too provide desirable temperature; this matter needs alone fossil fuels or electrical energy, and on of the ways for generating electrical energy is generating thermal through fossil fuels. It is notable that earth absorbs 46 % of sun's energy. It is shown in figure 1. Sun energy cause to keep fix earth internal temperature during of year.

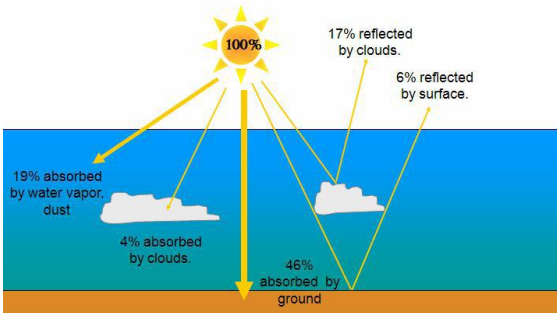

Fig 1: distributing sun energy.

It is concluded that, earth one of resource among a lot of energy resources; and we can say that earth is one of the valuable resources in geothermal domain.
On the other hand, we know that according to available documents in geological organization, the approximate degree of temperature in the depth about 6400 Km is 4000 c , that this matter causes to form malted materials with 650 – 1200 c thermal degree in average 90 Km depth from the surface of the earth. This process of distributing thermal causes to make 82 miliwatt energy in the surface of the earth (510 million square kilometer) all of this wasting energy is about 42 million megawatt.
We can say that, at first, this idea (the usage of geothermal energy) was suggested in Swiss country in 1912. Most of important surveying affairs in this field were conducted in United States in 1930 – 1940. It is notable that in 1950's, Edison power electricity institute made the first geothermal energy heat pump, that pump's type was annular. After that in 1970s after the first oil crisis, the great change was made in this industry and also it is continued. The countries which have most of shares in changing heat pump are as follow: United States – Europe – Japan and Turkey and 27 countries in the world have heat pumps in 2000 with 6875 megawatt warming and their yearly consumption content was 23278 Terajol [1-3].
Main geological phenomenon factors are earth quake and global activities and replacement of techtonical plates that they change ground into one resistant system and it is changing continuously. Geothermal energy in contrast to another renewable energy is considered as a stable energy that we can utilize it continuously. About 22 countries are generating electricity through geothermal energy now, their total nominal power almost more than 11000 megawatt, while about 50 to 60 countries of world are utilizing is energy about 15000 megawatt heat in another consumptins too [4].

2. The from of transferring earth thermal to ground surface

Thermal is transferring continuously from the core of earth to the crust of the ground and it is as a transferring heat to ground jobbe, if this thermal is enough, it can melt jobbe's rocks, so it causes to make «magma». Magma will move to crust sometimes hot magma gets to the surface of the ground and make «Lava». Often they aren't such that and magma will be left under crust and it warms surrounding rocks and water, we know this water as «warm water springs» most of this water in the depth of ground are locked in to the cracks and slotted rocks and slotted rocks and make geothermal energy resources. Figure 2 is show in hot steams that comes out from ground surface.

Fig 2: Hot steams that come out from ground surface.

3. The forming components of heat ground pumps

These pomp's have two main sections as follow:
I: under ground piping circuit in out of installations construction.
II: heat pump ser that is put in installations construction and pipes also include those pipes are in the buildings as a mother set. and, their task is processing air and supplying heat, outer pipes that have more important than internal heat, outer that has more important than internal pipes, can be an open or a close circle.
There is a total formula to calculate the depth of digging and the content receiving heat in the transformer length unit and the coefficient of conducting soil and amount of used hours of heat pump in year and the number of around digging can be effective in the amount of this parameter.
With having the amount of operator and heat pumps cold can be calculated the length of necessary digging.
It is got from relation 1:

$$\text{Length (m)} = \frac{\text{the capacity of heat pump operator (w)}}{\text{the price of receiving thermal in transformer length unit (w/m)}} \qquad (1)$$

We should consider these factors for correct selecting pump, They are as follow: 1-region geological properties 2- dimensions and opportunities for utilizing surface 3- necessary thermal properties 4- economical cost [1,2,5,6].

4. The efficiency of geothermal heat pump

We know that a heat pump don't generate heat directly, but it absorb energy from earth and transfer it. So it can make more energy than its consumption. This matter shows its high efficiency and its stability shows the moderation and stability of earth thermal for this reason we can use these pumps even for warming and cold residential buildings and official constructions. This is cause to decrease electricity energy consumption and desirable diamond [7].

5. The benefits and defects of using geothermal energy

5-1- These cases are the benefits of using geothermal energy

1-safety and positive environment aspect, because it isn't flammable and it doesn't produce gases such as dioxide, carbon and dioxide sulphur and nitrogen oxides and there isn't any flame, the risk of flaming isn't thrating. 2- We can say approximately, all of the people of world can install it and it occupies small place 3- It has better working conditions and providing higher comfort 4- Its efficiency and its installation capacity aren't dependant to climate. 5- Saving in consuming fossil fuels. 6- Its colding efficiency is 50 % to 70 % higher than common systems. 8- These pumps are without sounds and they are very safe and they are protected. 9- Using one more stable energy source and rather fix temperature in during year. 10- It has simple plan and less keeping cost.

5-2- We can say these cases for their defects

1-they needs to more initial investment.

2- Deep digging [8].

6. The usage of geothermal energy

People from last year have used warm waters which are made of geothermal energy and this water flows in the ground surface.

Such as Roman who uses this water for curing optical and skinny illness; some peoples exploited it for warming houses and even for cooking foods and drug usages in some regions. But nowadays people use it for generating electrical power by digging deep well in to the geothermal tanks and halting hot water and steam. In this type of power plants hot water and steam that were came out from geothermal tanks, supply necessary energy for turning turbine generator and they produce electrical energy using water comes back to the tanks through injecting walls to warm again and at the same time the pressure of tank is kept and making hot water and steam are consolidated and fixed [9].

6-1- Direct usage

That is thermal energy is used without medium. This method for turning into electrical energy hasn't economical justification, because it's temperature is low (about 50 to 150 c) so, for this reason, it is used for swimming pool and bathing centers and constructions warming and colding (through heat pump), water cure bathroom, agriculture (almost for warming green house and animal husbandry) making necessary warm in pond and fish breeding chanals and industrial process.

6-2- Indirect usages

Natural hot steams or hot water are directed to the surface of the ground for generating electricity form internal of digged well for rotating turbine. This rotating of turbines (special turbines) cause to rotate transformer and finally it causes to generate electrical power the first geothermal power plant installation was lard lo Italy in 1940, and it generates electrical power more than 137 megawatt. But it was destroyed in the Second World War. But after war and after reconstructing its capacity got to 380 mega watt electricity in 1975. Newzeland was the first country which was installed two geothermal power plants in 1958, and that provides some of economical electrical energy for this country, and after that U.S.A installed power plant in Big girz Zone that is utilized from dried steam of geothermal field. Thermal energy

hasn't much usage until before 1970s, because fossil fuels were cheap. And so, it doesn't special progress.
Increasing electricity producing capacity in several hundred megawatt scales and also, direct usage in during three decades are shown excellent progress in this field. Now, 22 countries of world are generating electrical energy through this way, and this generating is more than 11000 megawatt and American and Philippine as order with producing 3000 megawatt and 2000 megawatt are in the first and second grade.

7. The situation of Iran about geothermal energy

We can produce 90.000 megawatt electrical energy to 2020 by advancing civil life and economical energy in our dear country, that it is about 98 % our current country capacity now while most of current power plants are fossil that are limited so, it forced us to generate energy through ways that are independent fossil fuels. though very suitable potential for geothermal energy usage and for the absence of suitable policies in macro level in this field and because there isn't any technology about deep digging, construction and tanks engineering and also exploiting of geothermal plants and especially fossil fuels are cheap in our country that is very big rival of thermal energy, exploiting of this energy and finding potential in different regions of country didn't consider seriously. Beside, Ardabil – Sabalan she has started to install since 1381. Figure 3 we showed geothermal potential regions in Iran.

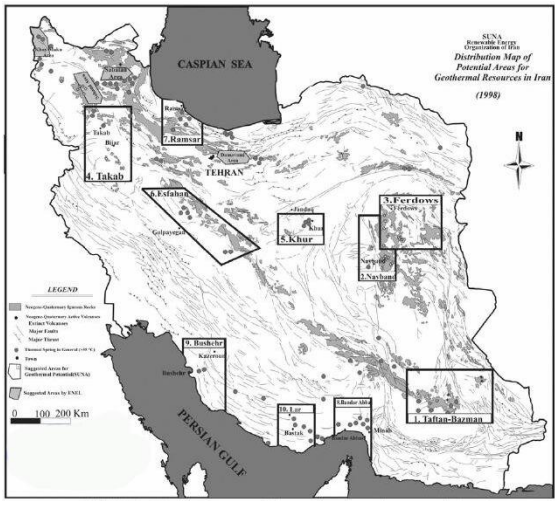

Fig 3: geothermal potential regions of Iran

8. Determining regions that have potential with geographical information system (GIS)

As it is obvious from the name of this method, we can use this way as a index for deciding and as a powerful tool for determining regions that have geothermal energy potentiality and at last this determining causes to optimal exploiting this natural energy, that is geothermal, after discovering and necessary studies and surveying remarkable region, geothermal site is selected at the first step, we discuss available data layers for exploring geothermal resources in national measure a in three sets :
1- Earth quake micrograph and shallow crust to extract resources (geophysics)
2- Geology (fissure, craters and volcanic rocks)

3- Warm water and acid springs and hidrothermal changes in region (geochemistry)
And the second step is planning and conducting in GIS environment and regions have potential and geothermal energy weave come ready for using information and doing activities according to GIS method. At last 16 regions from all of Iran have geothermal by surveying and studying.
The conclusions of received maps in GIS method can be received after many analyzing. So we can say it is without any mankind errors, received data from this method are used by two methods: gathering activity and subscription activity. This activity can be done from this relation:

$$S = (F \cup VR \cup VC \cup VM) \cap (Mis \cup IB \cup Mas) \cap (AZ \cup HS) \qquad (2)$$

Which in (2) F (fissure), VR (volcanic rocks), VC (volcanic cold matters) and VM (volcanic matter) MIS (region changes) and IB (big shakes and out crusts) and MIS (micro shake) and AZ (warm water springs) and HC (lava).
Geothermal energy craters may consist of ground natural thermal with active volcano and new passive volcano. These craters are west north and the east of our country that about 47 craters are discovered in Iran and they can be considered to geothermal energy. Volcanic rocks in our country are found considerably from west north to east south and on the north section of country in Alborz and Zagros Mountains. They are about 145973 KM.
also, understanding fissure‘s function in controlling the flow of under layer can be played important role in considering geothermal potential region hot water springs is showing regions have geothermal potential regions. Hot water springs is showing regions have geothermal potential and it can be as a source if suitable undersurface thermal for exploiting and also the probability of presence of energy source around it isn’t little the volcanic matters of shallow things on surface layers are dipped and they are from volcanic rocks and they cold gently in outer surfaces. In some of geothermal fields, young volcanic matters has important role as a source for providing part of geothermal energy [10,11].

Data set	Index layers	Approximate distance (meter)
geology	Volcanic rock Volcanic grain Volcanic lava Fissure (fault)	5000 5000 5000 6000
geochemistry	Regions changes warm water springs	5000 4000
geophysics	Micro shake Without interfering Macro shake	40000 5000 5000

Table 1. Different matters of indices with sizes

So, paying attention to place and the presence of rocks in low depth are major are important points in exploring geothermal. Selecting maps is very important to prevent extra const, and it is got by merging data in functional models, that are for unifying information about regions which have geothermal potential. They are considered as a kind of special and important key skills to show conclusions about surveying maps.
Table 2 shows different matters of indices with sizes and Table 2 shows received information from regions that have potential with approximate area.

The regions have geothermal potential	approximate (Km2)
Mazandaran - ramsar	5532
Mazandaran - amol	1697
Hormozgan - larbastak	4191
Hormozgan - minab	3191
Kerman - baft	11525
Ardebil - sabaln	13037
Azarbayejan gharbi- khoy , mako	3257
Azarbayejan sharghi - sahand	3174
Tehran - damavand	4648
Khorasan jonobi – tabas & ferdous	46628
Sistan & balochestan - taftan	4310
Sistan & balochestan - bazman	8356
Khorasan center - kashmar	7107
Esfahan - kashmar	13658
Hamedan - avaj	4283
Zanjan - zanjan	3258

Table 2. Received information from regions that have potential with approximate area

9. The used methods for turning geothermal energy into electricity
These ways are as follow:

- Power plant resulted from hot water.
- Mixed power plant from steam and hot water.
- Dry power – plant
- Geothermal power – plant with immediate evaporation
- Geothermal power – plant with two- circuit circle

9-1- power – plant resulted from hot water

These type of power – plants installed on tanks which have hot water in this tanks, hot water are come to surface by digging well and some of it turn into steam for gertting free from tanks pressure; and this steam is used it, first times.

9-2- mixed power – plant with steam and hot water

In this method hot water passes among thermal transformer sets, liquid turn to steam as a result of warming and it turn turbine and transformer liquid, itself come back to system (closed – circuit system). And it become ready to use and geothermal water is injected to tanks two times, this method is used for using tanks which aren't warm enough to generate steam with pressure.

9-3- dry power – plant

These kinds of power plant are made on the geothermal tanks which produce very, little dry steam and steam directs to turbines blade and cause to turn it.

These kinds of tanks are rare, the greatest dry steam field in the world is jizerz that is about 90 miles from the north of California; it is installed in 1962 and it is one of the most successful projects for generating energy.

9-4 geothermal power – plant with immediate evaporation

In these types of power – plants, fluids which is extracted from the depth of ground by geothermal well and they are usually in from of liquid and steam and the steam is separated thorough this method and is directed to turbine and it causes to rotate turbine and causes to rotate generator axis and it generates electricity.

9-5- geothermal power plant [power station] with two circuit circles

The hot water which is extracted in these power plants comes into thermal trans former and it give its warmth to another liquid and its boiling temperature is lower than water and it turn it into steam and steam is directed to turbine and rotate turbine.

10. Conclusions

Heat pumps are one of the most effective and use full sets to provide warming and colding energy in constructuting installations. They have great stability, because geothermal sources have stability. They consume very little energy and have very excellent efficiency and their keeping and repairing cost is low and don't make vocal pollution and they have small density and they are compatible with environment. But, using these pumps haven't economical (explanation by economical analyzing with available situation in Iran. but it is received economical justification, by eliminating subsidy and bearer energy that the time of come backing investment is about three years. We can consider 16 geothermal domains in Iran by paying attention to geothermal potential in different regions of Iran and by geological information such as crater, An totally %12 of Iran's area are as a regions have geothermal potential and the site of this energy is potential. All of these subjects should be examined and investigated more.

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