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Design and Re-Use Of Shovadans In Today's Architecture "With Due Attention To Have Thermal Energy Of The Earth"

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Abstract *- In old time, people were making their buildings and structures in a way to be in proportion with the climate and native culture of their area. Currently, with the most advanced science of architecture, design secrets of the old buildings have been discovered. "Shovadan" is an example of such design that was built in cold regions of Iran such as Hamadan City; so these spaces can be used in winter to use the heat of the earth. Shovadans are series of corridors and hallways of the underground that were used in cold regions by people. So, in this article, we purpose to change the Shovadan's application in order to have as a thermal tunnel to use the earth energy. They must be designed just like previous samples as a corridor in the earth, but in more depth, so we can have and use the energy of the earth in more volumes. In this case, the heat of the earth will be guided in side of the buildings, and in addition to save energy consumption, we will share the old architecture as today's style because of the developing of technology day to day.*

Keywords *- Sustainable Building, Shovadan, Geothermal Energy.*

1. INTRODUCTION

Iranian architect with having historical experience and plural thoughts of last decades is looking completely and widely to the heating and cooling ways of buildings, at the same time, is avoiding any excesses and extravagance. Relying on these documents, the public believe that Iran's past within architecture has been "Sustainable Architecture" (Hossainian, 2004). The main issue of today's architecture is disconnection between traditional architecture and modern needs. Now, the man in terms of saving energy is in a position that has never been so much critical. For implementation of permanent measures of saving energy, precise control of consumption in buildings is vital affair. The way to achieve this goal can be the using a model of sustainable architecture. In Iran's architecture, there are lot of values; but the education of today's architecture, have withdrawn the access to many of them (Safayi, 2009).In traditional architecture of Iran, the building is repelling with outside environment according to its geographic position, in away to to prepare the best interior space without using complex and unclean energy systems. In other words, the people of past in Iran had the most awareness of rules and sustainable systems and have used them constantly; but they have not been researched in scientific themes completely and have not been collected in to a book (Kasmayi, 2005).This article tries to mention to one of the types of renewable energy as the "Geothermal Energy" that has been considered from the past. Iran's settling on the world's geothermal belt, confirm the necessity attention to this kind of renewable energy. Despite the immense importance of this energy, it has not been considered significantly in the design of new buildings. So in this research, some of the sustainable patterns relating to this energy are researched to find a way of using them again in new buildings. An example of these traditional patterns are shovadans which are made and used in various Iranians cities in order to have heating, cooling and to save energy (Ghobadiyan, 2005).

2. NECESSITY OF SAVING ENERGY

Because of the world's energy crisis creation and environmental pollution increasing due to the indiscriminate use of fossil energy, the necessity of sustainable energy using has been considered, especially in the construction sector which is allocated the 40 percent of energy consumption in the country.

2.1 GEOTHERMAL ENERGY

Thermal energy in the solid crust of the earth is called geothermal energy. Earth's center is a huge source of thermal energy which is in various forms such as volcanic eruptions, hot water or are leaded to surface due to the conduction property. Currently, geothermal energy in many parts of the world and in different ways is used widely. Researchers, with using old technology in supplying energy, have been completed the development of new ways in supplying energy. Utilization of geothermal energy, as a potential energy source in the depth of the ground, has been independent of atmospheric conditions and has ability to respond to the needs of the current and future.

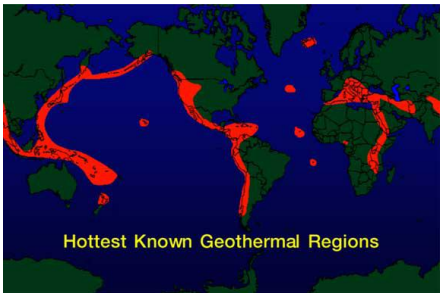

FIGURE 1: The Use of Geothermal Energy

The depth of the earth is a huge reservoir of heat that occurs in rocks by the pressure of small amount of natural radioactive elements. When the heat reaches the surface of earth, this heating energy can be used to serve for the welfare and human consumption. Although the usage of thermal energy as the renewal and famous one is not a new issue; but saving the energy, especially the heat and the cold of inside the earth, under the building that is established on them, is newer than other renewable energies. In this case, in the past of our country, for having necessary heat and cold energies in different seasons, people were using the places by the name of Ice-Houses and Shovadans (Fasihi, 2004).

2.2. THE BENEFITS OF GEOTHERMAL ENERGY

The use of geothermal energy has several advantages over the use of fossil fuel resources. The main advantage is lack of fuel costs. The use of geothermal energy has several advantages over the use of fossil fuel resources. The main advantage is lack of fuel costs. From the point of natural impact, the amount of undesirable gases produced in these power houses is limited. Another advantage of these power houses can be a fixed amount of energy being extracted in all seasons and the ability of their operation in 24 hours continuously. From economic perspective, the use of geothermal resources, are reducing the amount of dependency of electricity prices on the price of fossil fuels (tabrizi, 2003).

2.3. THE ENERGY OF THE EARTH DEPTH

It is about centuries that "Heat within the Earth" is being exploited. Even the ancient Romans were using it for the bath heating. Placement of buildings inside the land is an answer to many needs and problems related to climate. Weathering and temperature fluctuations have very little impact on tectonic structures, and the earth crust like a buffer is protecting the structures against these changes. Storm and wind cannot penetrate in to the ground and the earth crust as a thick thermal insulation prevent of heating transfer inside of the land. Whatever the building is settled in the depths of the earth, because the soil thickness is more, temperature changes will be less too. Above the 6/1 depth of the earth, the temperature is almost constant and equal to the average annual temperature in outer space of the place (Fasihi, 2004).

"The Buildings Underground" has great function in receiving and protection energy; because they receive light and heating from the south side by the sun and by having thick covering of the earth around them, this heating will be kept inside the building and there will not be much need for mechanical installation such as heating and stove systems for having enough heat in the winter. In cities and villages of Iran, there are various buildings that have been settled in the ground because of the climatic issues in order to use the energy of depth such as baths, mosques, water reservoirs, glaciers and underground villages. Examples of these sustainable underground architectures are Cellars and Shovadans.

3. HAMADAN CITY, IRAN

One of the western and mountainous cities of Iran is Hamadan. This city is located in the foot of mountain, in the height of 1800m above sea level and, is one the coldest cities of Iran (Safayi, 2010).

3.1. THE GEOGRAPHICAL LOCATION OF HAMADAN

3.2. CLIMATIC CONDITIONS AND CLIMATIC CHARACTERISTICS

General climate of this region are: 1. severe cold in winter and cool in summer. 2. Very large difference in temperature between night and day. 3. Heavy Snow. 4. Low Air Humidity. The average temperature in the warmest month of the year is more than 10° C and the average air temperature in the coldest month of the year is less than -3° C. Temperature fluctuations during one day is more in mountain regions. In this climate, valleys are very hot in summer and temperate in winter. The amount of sun shine is very much in summer and very low in winter. Long winters are cold and severe and in some months of year, the ground is covered with ice. The spring is in short time and is separating the summer and winter from each other. Cold starts from early December and will continue to late March. Hamadan groundwater level is low, and this issue has been instrumental in expanding of Shovadans (Safayi, 2010).

FIGURE 2: Longitudinal Section of the Street which have path to each other

4. SHOVADAN

Shovadan includes rooms (without constructing walls and roofs) that are about 6 to 7 meters below the surface of yard. Temperature in the rooms is 25° C all year around. Shovadans have vertical channels for the lightening and the channel lighthouse has been in the yard. Some Shovadans have been ventilated by wind wards (Ghobadiyan, 2004).

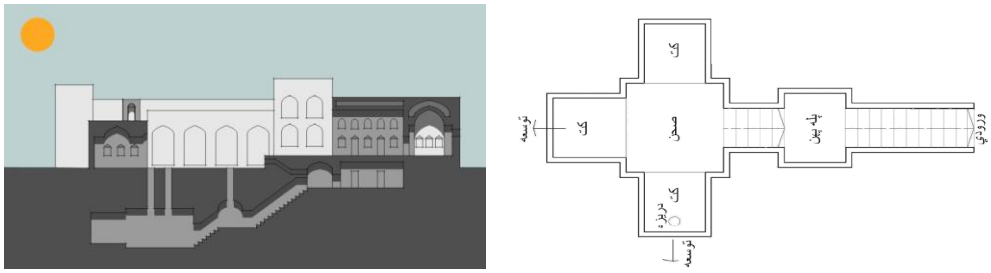

FIGURE 3: The Plan and Section of Shovadan

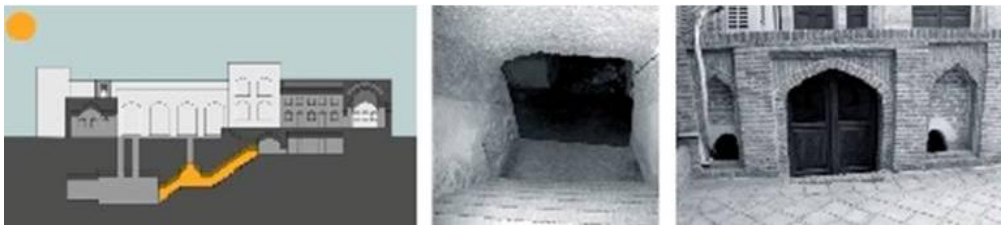

FIGURE 4: Shovadan Components: Stairs

FIGURE 5: Shovadan Components: Court Yard

FIGURE 6: Shovadan Components: Horizontal Channels

FIGURE 7: Shovadan Components: Loophole

Stair is the connection component between building and Shovadan. In some of them, the numbers of Shovadans stairs reach to 40. Stair is the connection component between building and Shovadan. In some of them, the numbers of Shovadans stairs reach to 40. The Court yard is the main hall in Shovadans and the main activity of the life occurs in it. Horizontal channels which are narrow and making relationship between Shovadans of neighborhood, they cause air flowing too. Loophole is cylindrical pore with diameter of about 1m, to provide light and ventilation (Safayi, 2010).

5. REUSE THE SHOVADANS, STRATEGY AND TAKE ADVANTAGES OF GEOTHERMAL ENERGY

5.1. HOMES HEATING:

By having pipe-laying and especial radiators as the existing heating systems, we can transfer geothermal hot water into the home environment, Shovadans floor and etc.; to use the heating of this water to provide for inside of the buildings. For home heating water, geothermal heat should be about 50° C to 100° C. We can also have this pipe-laying from the Shovadans floor to reach to more depth of the ground.

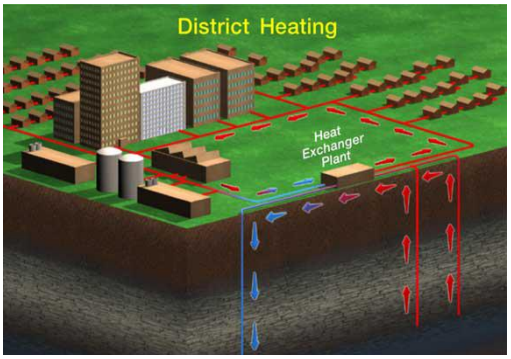

Figure 8: How to Use Geothermal Energy for Homes Heating

5.1. OFFERING SOLUTIONS FOR USING GEOTHERMAL ENERGY

There are geothermal potential in different parts of the country which will have great impact in economy and environment and will also to create jobs, tourist attraction, production increasing and etc. (Fasihi, 2004). For eliminating the necessity of energy and heating homes, especially in winter, we can use from geothermal energy; so geothermal heating pumps can be used in this work. Geothermal heating pumps for living space heating, water treatment and swimming in hot springs, greenhouses, fish farming, drying fruits and etc. are different (Tabrizi, 2003). In underground spaces, examination fees for the use of heat and cold, is lower about 80 percent than using in conventional buildings and minimal damaging shall be entered to nature (Saremi, 1996).

6. Conclusion

In the present paper, the potential of geothermal energy, with emphasis on the role Iran's past architecture was described. The review and analysis of traditional architecture elements were done to reach the solutions for better use of new energies in the context of modern buildings Recommended actions are presented in this paper, can provide future research applications. Some of them can be a new research topic too. Development of modern underground houses, covering the exterior walls with soil, having residential buildings heating with geothermal pumps, using hot water of springs for factories, power generation, construction of huge buildings and so on, are practical actions that can be perused. It is hoped, by the help of these effective strategies, we can be able to achieve climate and energy efficiency principles and maintaining the living environment.

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