Proceedings World Geothermal Congress 2020+1
Reykjavik, Iceland, April - October 2021

New Status of Geothermal Heat Pumps in Iran

Soheil Porkhial, Mohsen Taghaddosi, Parham Porkhial

Department of Mechatronic Karaj Branch, Islamic Azad University, Tehran, Iran

porkhial@yahoo.com ----------

mo.taghaddosi@gmail.com

Keywords: geothermal, status, Iran, heat pump

ABSTRACT

Iran is a country that is blessed with an abundance of fossil fuel in the form of oil and gas. It has the second largest gas reservoir and also huge oil reservoirs. However, Iran has also a good potential for renewable energy such as geothermal, wind, and solar that it wants to use for the benefit of its people. There are many different types of climates in Iran. In summer, most of the cities and villages have high temperature (35-50`C) for 4-6 months. In the north of Persian Gulf and Oman Sea , as well as in the south of Caspian Sea, many people use air conditions due to the high humidity. In winter, especially in mountainous regions, the weather is very cold (-15 to -5`C) for 4-6 months, causing many people to use gas heaters.

The electricity network had been developed in most cities and villages, also the gas network had been installed in most cities. However, there are many villages (near 5000 villages) that are too far from gas network, and there is no economic justification for developing the gas network in these areas. According to this information, the government tries to prepare some plans for using geothermal heat pumps (GHP) as a cooling and heating system for decreasing the energy consumption. Installing 110 kWt pilot and sample geothermal heat pumps for presenting the GHP cooling and heating systems is one of the important parts of plan. In this paper, the status of geothermal heat pumps is discussed.

1. INTRODUCTION

Iran is a country found in the Middle East. Its coordinates are 35 °41 N 51 °25 E. Iran has a variable climate. In the northwest and mountainous places, winters are cold with heavy snowfall and subfreezing temperatures (-15 to -20°C) during October to March. Spring and fall are relatively mild, while summers are dry and hot. In the south, winters are mild and the summers are very hot, having average daily temperatures exceeding 45-50 °C from April through September. The heat is often accompanied by high humidity. In the south of the Caspian Sea the weather is cold in winter and hot with high humidity in summer. Because Iran has the second largest gas reservoir in the world, the gas pipeline network has been installed at a very high price and the gas has been burned for heating. In summer in north of Persian Gulf, Oman Sea, and south of Caspian Sea, air to air cooling systems have been used for cooling due to the high temperature and humidity. Most of gas heaters and air to air cooling systems have very low efficiency and very high energy demand. According to this information, some geothermal heat pump pilot projects have been introduced by the Renewable Energy Organization of Iran on behalf of power ministry in order to reduce the power load. Also some geothermal heat pump pilot projects have been introduced by the National Iranian Gas Company (NIGC) on behalf of the Petroleum Ministry for heating the houses that are located in villages or cities that are far from the gas network.

2- HEAT PUMP STATUS

Activities of heat pump started 2005 by changing Air to Air heat pump to water to air heat pump. In this study we got 30 percent of saving energy. After this first step for demonstration of geothermal heat pump to governmental decision maker, they asked to install 4 standard heat pumps in 4 different climates. Therefore we bought 4 FHP heat pump with 1.5 TR capacity and installed in following locations

Rasht city as representative for wet and normal climate

Bandar Abbas city as representative of wet and tropical climate

Ahvaz as representative for dry and tropical climate

Taleghan as representative for cold climate

After installation this heat pumps with ground heat exchangers we install data loggers on them. According to data gathered we calculate 60 percent of saving energy compered to air to air heat pumps. One of the problems for developing the geothermal heat pumps was sanctions of Iran. Because the price of heat pump increased by 2 times. Now we have a local company which could product this equipment. Another problem was companies which could install ground heat exchangers in large scale and for solving this problem we need to develop market of heat pump. If the companies have good contracts then bought drilling rigs and other requirements for installations. There are big market in government building special in oil and gas industry, power industry and MUNICIPALITY. For developing heat pumps in private building we need subside for geothermal heat pumps. Suna is studding on it and try to get budget for them. Fig 2 shows distribution of géothermal heat pumps in Iran .Fig 1 shows annual and total installed capacity of geothermal heat pumps in Iran. Table 1 give geothermal (ground source) heat pumps as of 31 August 2019

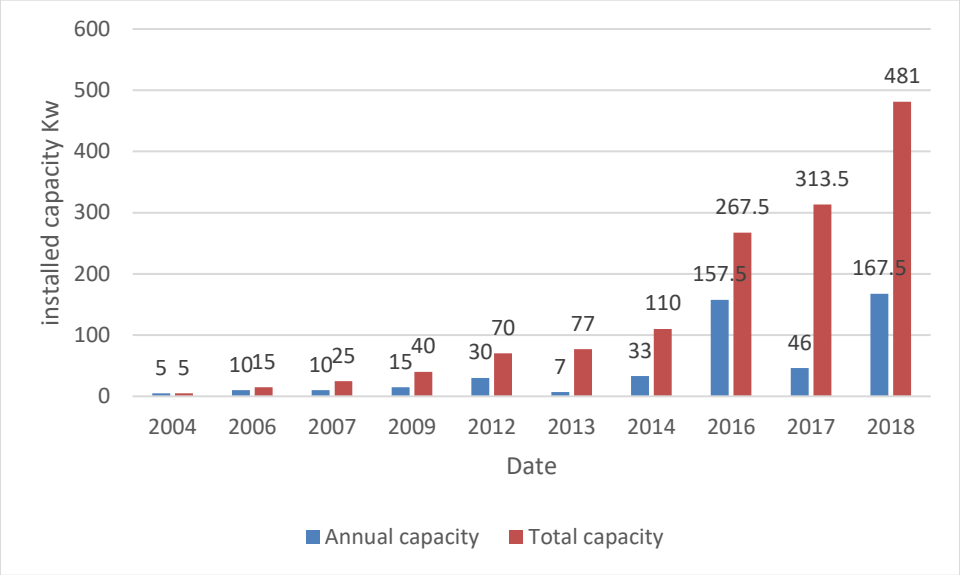

Fig 1 annual and total installed capacity of geothermal heat pumps in Iran

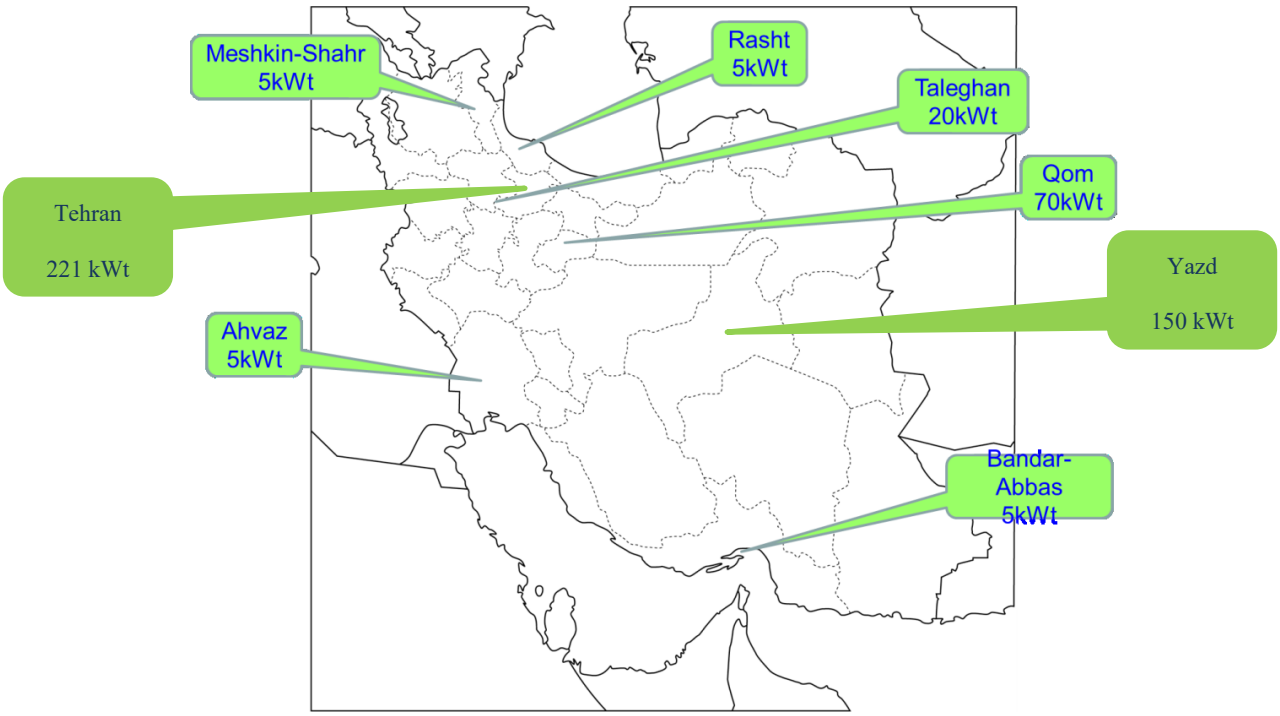

Fig 2 Distribution of geothermal heat pumps in Iran

TABLE 1. GEOTHERMAL (GROUND-SOURCE) HEAT PUMPS AS OF 31 DECEMBER 2014

[2)] Report type of installation as follows:

W = water source (well or lake water)
O = others (please describe)
V = vertical ground coupled
H = horizontal ground coupled

Locality	Ground or Water Temp. (°C)[1)]	Typical Heat Pump Rating or Capacity (kW)	Number of Units	Type[2)]
Rasht	25	5	1	h-v
Meshkin-Shahr	20	5	1	h
Taleghan	22	20	4	v-h
Ahvaz	26	5	1	Slinky
Bandar Abbas	26	5	1	Slinky
Qom (Jemezghan)	19	10	3	v
Qom(ghanavat)	25	35	1	v
Qom(salarieh)	24	5	1	Slinky
mashad	22	21	1	o
Tehran Vardavard	18	157.5	9	v
Tehran-municipality -22	20	21	1	v
Tehran-municipality -1	20	15	1	v
Tehran-municipality -11	20	10	1	v
Tehran -university	22	17.5	1	v
Yazd-university	22	150	5	v-h-slinky
TOTAL		482	32	

3. CONCULUSION

Iran has the second largest gas reservoir in the world. Natural gas have been used for heating and also for generating electricity in power plants. Gas heaters use lots of energy and have low efficiency. Therefore, several big projects for replacing the gas heaters with geothermal heat pumps have been started by the National Iranian Gas Company (NIGC). The capacity of these projects is 7500KWt. Geothermal heat pump projects as a cooling system have also been started by ministry of power and energy. The total capacity of these projects is more than 4800KWt

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