American Journal of Engineering Research (AJER)
E-ISSN: 2320-0847 p-ISSN: 2320-0936
Volume-7, Issue-12, pp-185-189
www.ajer.org
Research Paper Open Access

Controlling Pi Monitored Engine Cycle Setting According To Pressure Differences In Water Flowing In Geothermal Pipes

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ABSTRACT: *In this study, it is necessary to give continuous high temperature to the subscribers as a result of not being able to provide control with manual, mechanical, semi-automatic control systems or with proportional valves. In geothermal heating centers where heat balancing cannot be done, continuous hot water must be pumped in order to provide the heat required by the subscribers. Continuous pumping of hot water also means excessive electrical energy expenditure. At the end of this study, a large amount of electricity was saved by providing the motors in the well, which provides hot water to the subscribers, working according to the load. PI controlled control was carried out with the aid of relays control over electric pump motors. The operator is also programmed to perform operations such as observation and adjustment of the system with the panels.*

Date of Submission: 01-12-2018 Date of Acceptance: 31-12-2018

I. INTRODUCTION

Geothermal energy, which is one of the most important renewable energy sources, is a resource that can be used in many areas such as electricity generation, medicine, tourism, agriculture and industry [1]. Geothermal energy is an inexhaustible and renewable alternative energy source. Geothermal energy; Environmentally friendly, cheap, renewable and national energy. The most important uses of geothermal energy are heating of houses and greenhouses [2]. The geothermal source can be defined as hot water and steam, which is composed of accumulated heat at various depths of the earth's crust, whose temperatures are constantly above the regional atmospheric average temperature and may contain more molten minerals, various salts and gases than the normal underground and surface waters around it. Geothermal energy includes all kinds of direct or indirect benefits [3]. World energy consumption; In parallel with population growth, industrialization and technological developments, it is growing at a dizzying pace and as a result of the 21st century, there is a society that absorbs energy. Today, 84% of the world energy requirement is met by fossil fuels such as coal, oil and natural gas, and the remaining 16% is covered by resources such as animal and plant waste, wind, solar and geothermal energy. The global reserves of fossil fuels are estimated to be 68% coal, 18% petroleum, and 14% natural gas as the equivalent of oil [4]. It has been investigated whether the utilization of geothermal energy in heating of buildings is economical. For this purpose, an economical analysis of the fuels used in the heating of a 100 m2 apartment was doned. As a result of the economic analysis, geothermal energy is more economical than other alternative energy sources [5]. The Aegean region has a rich potential for geothermal energy and ranks first in geothermal greenhouse cultivation [6]. Simav is 1568 km² and it is 143 km far from Kütahya city center. The population of the district center is 25831 [7]. Geothermal energy will be largely used locally and will play an integrative role. On the other hand, if solutions to regional and global energy problems are found, it is important that local energy sources participate in the national grid, where both local and imported energy is best used [8]. The economic development of countries rapidly increases the need for energy. For this reason, countries are exploring the ways in which they benefit more economically from conventional energy sources as well as from renewable energy sources [9].

II. METHODS AND MATERIALS

The circuit elements used in our study are shown below. PI controlled control was carried out with the aid of relays control over electric pump motors. The operator is also programmed to perform operations such as observation and adjustment of the system with the panels. When the heat exchanger return temperature is controlled by proportional valves and optimum heat transfer is provided to each subscriber, there will be no need to pump water at high pressure. The circulation of the circulation pump motors is adjusted according to the pressure in the geothermal pipes.

Speed control of the large power induction motors used to deliver the hot (thermal) water in the heat exchanger centers to the subscribers was also provided and tested by the PI-controlled Siemens LOGO smart devices based on the pressure differences in the pipes in the geothermal system.

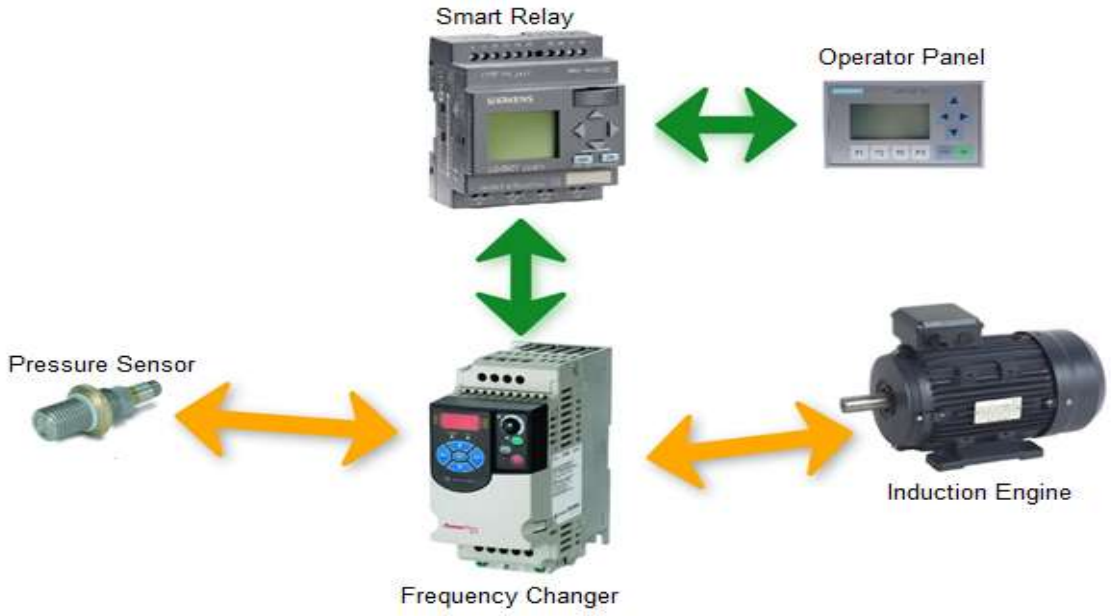

Figure 1. Speed Control System

2.1. Pressure sensor

The size of the force applied to the unit area is called pressure. Sensors that measure the pressure of liquids or gases are called pressure sensors. The pressure sensor works like a transducer. It generates a signal in the range of 4-20 mA or 0-10 volts. This signal is converted to analogue value in digital pressure gauge and its value is displayed on the screen. The signal value generated depending on the pressure is used in the control system which is planned to be transferred to the smart relay or PLC by the help of analog modules**.**

Figure 2. Pressure Sensors

2.2. Speed Controller (Frequency Converters)

Electronic devices that control the speed of an electric motor are called kon speed converters elektronik or ı speed controllers Bir.There is an electronic drive circuit in the drive that allows the asynchronous motor to

rotate at the desired speed. Alternating current drives make the motor speed by changing the input voltage and frequency of the motor. As the voltage frequency decreases, the speed of the motor decreases and when the frequency is increased, the speed of the motor increases. The speed of the motor varies with the frequency. 3-phase Asynchronousmotors are not easy to change the speed of AC drives are preferred.

Figure 3. Speed Control Devices in various brands

Alternating current drives operate like a rectifier. Speed converts the alternating current coming into the control with the help of diodes. With the help of the converted direct current capacitor, a flat voltage is obtained and converted back to the alternating voltage. By applying the desired frequency to the motor, it is ensured that the asynchronous motor rotates at the desired speed.

2.3. Proportional + Integral Control (PI)

Off-set in proportional control can be removed manually or automatically. The difference between the measured value and the set value is integral with the time signal. This integral value is collected by the difference value and the proportional effect is eliminated. In this way, the energy supplied to the system is automatically increased or decreased, and the process value is set to the set point. The integrator circuit continues until the difference between the setpoint and the measured value changes. As soon as the difference signal is zero, there is no signal to integrate the integrator circuit. The most distinctive feature of the proportional + integral control is that the amplitude of the system exceeds the set value at the first moment, and a significant amount of deviation (overshoot). After a one or two oscillations around the set value, it sits at the setpoint [10].

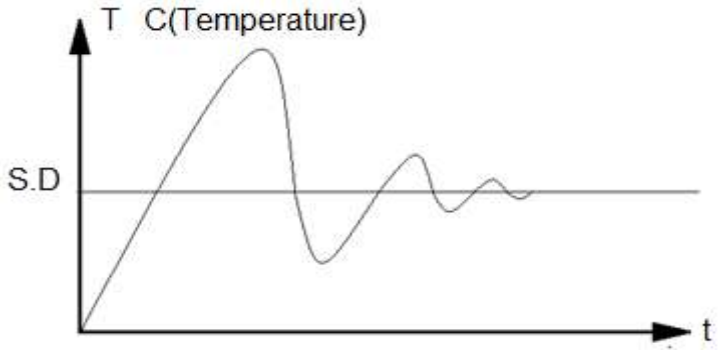

Figure 4. Proportional + integral reaction curve[10].

3. Operator Panel Screens and System Operation of Speed Control Control of PI Controlled Geothermal Water Pump Motors

Intelligent relay with PI control software is used in the speed control application of circulation pump motors at the heat exchanger centers based on pressure changes. Setting and impression control is provided by using the LOGO TD panel belonging to this relay. It can be used on other operator panels if desired.

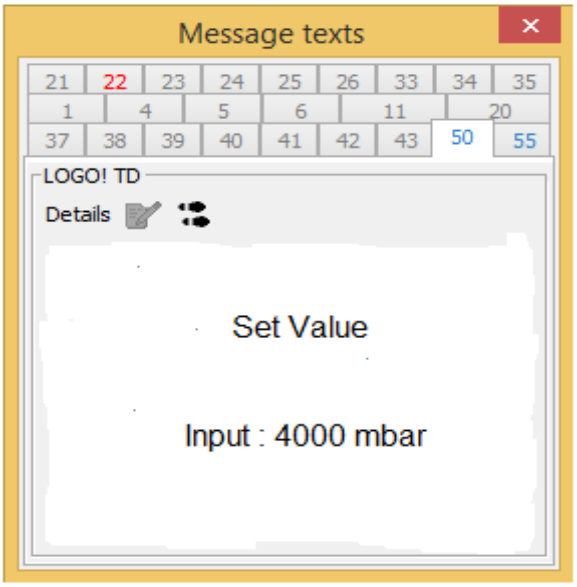

Figure 5. Display of Pressure Set Value

The pressure setpoint is entered from the front display in the form of millibars. When the operation button is pressed, the analog output (AQ) connected to the smart relay according to the pressure sensor generates a voltage between 0-10 volts. If the pressure in the pipes is less than the set value, the signal voltage of 0-10V from the analog output is given to the analog input in the speed control (Frequency Converter / Frequency converter) unit as high value. When the analog input value in the speed controller increases, the frequency given to the asynchronous motor will increase and the pump motor speed will increase. If the pressure in the pipes is above the set value, the analog output signal voltage will decrease, the speed control input signal will be low, as the frequency of the asynchronous circulation pump motors will decrease as the frequency given to the motor will decrease. Depending on the pressure, the motor speed control is designed as PI controlled.

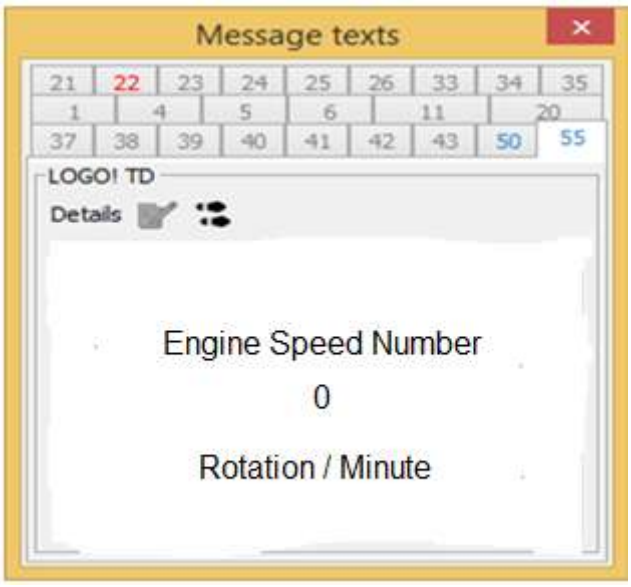

Figure 6. Display of Circulation Pump Motor Revolutions per Minute

The number of revolutions per minute of the electric pump motor will be seen from this screen. A bar graph can also be added to the screen if desired.

III. RESULT

When the proportional valve control is performed, heat transfer will be provided to each subscriber as much as necessary. As all subscribers receive heat of equal and sufficient value, there will be no need to continuously pump high pressure hot water. As the demand falls, the pressure in the geothermal water pipes will

increase, and the large powerful electric motors will work at lower revs and pump water to the system.Heat exchanger return temperatures in buildings will be brought to low level by means of proportional valve control. The heat exchanger return temperatures of the automatically reduced building will decrease the pressure in the geothermal transmission pipes and therefore cause the asynchronous motors to decrease. Low power consumption of large power circulation pumps will reduce electricity consumption too much

REFERENCES

[1]. Özlem Candan KÜLEKÇİ, Ö. C.(2009) Ankara Üniversitesi Çevre Bilimleri Dergisi
[2]. Yonar G., (2007), Jeotermal enerji ile ısıtılan Kütahya ili Simav ilçesindeki ısıtma sisteminin çevresel etkilerinin değerlendirilmesi ve uygulanması gereken yenilikler, Yüksek Lisans Tezi, Gazi Üniversitesi Fen Bilimleri Enstitüsü, Ankara.
[3]. DPT "Jeotermal Enerji Çalışma Grubu Raporu", Devlet Planlama Teşkilatı, Sekizinci Beş Yıllık Kalkınma Planı, Madencilik Özel İhtisas Komisyonu Raporu**,** Ankara, (2001).
[4]. Vogel, C., (1999). Coals Role in Electrical Power Generation: Will it Remain Competitive The Proceedings of the Technical Conference on Coal Utilization and Fuel Systems, Coal and Slurry Technology Association, pp:13-24.
[5]. GÜNTÜRKÜN, R. Şahin Hasan, "BİNA ISITILMASINDA JEOTERMAL ENERJİ İLE SOMA LİNYİT KÖMÜRÜ VE FUEL-OİLİN EKONOMİK YÖNDEN KARŞILAŞTIRILMASI", ISSN:1306-3111, e-Journal of New World Sciences Academy, 2008, 3(2), 391-408.
[6]. Kendirli, B. & Çakmak, B. (2010). Yenilenebilir Enerji Kaynaklarının Sera Isıtmasında Kullanımı, Ankara Üniversitesi Çevre Sorunları Araştırma Uygulama Merkezi, Çevre Bilimleri Dergisi, 2/1, 95-103.
[7]. Türkiye İstatistik Kurumu, (2015). http://www.tuik.gov.tr adresinden 14.12.2015 tarihinde erişildi.
[8]. Serpen, U, 2005. "Jeotermal Enerjinin Türkiye ve Dünyada Kullanımı, Tesisat Kongresi, Jeotermal Enerji Semineri 2005 Kitabi." Kasım, Izmir, pp. 435-447.
[9]. *Yrd. Doç. Dr. Melis ÇERÇİOĞLU, Öğr. Gör. Hasan ŞAHİN, "*Sİ*MAV'DAKİ SERALARIN ISITILMASINDA JEOTERMAL ENERJİ KULLANIMI***", International Journal of Social Science Doi number:http://dx.doi.org/10.9761/JASSS3477,*** Number: 47 , p. 459-475, Summer I 2016,
[10]. Şener A. C., Günerhan G.G., 2001 Jeotermal bölgesel ısıtma sistemlerinde otomatik kontrol, jeotermal enerji semineri

Erhan GÜNGÖR, "Controlling Pi Monitored Engine Cycle Setting According To Pressure Differences In Water Flowing In Geothermal Pipes" American Journal of Engineering Research (AJER), vol.7, no.12, 2018,pp.185-189