Proceedings World Geothermal Congress 2010
Bali, Indonesia, 25-29 April 2010

Socioeconomic Impacts of Balcova Geothermal District Heating System-Turkey (BGDHS)

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Keywords: Socioeconomical impact, Balcova geothermal district heating system, Turkey

ABSTRACT

The environmental impacts of geothermal development projects (GDP) are gaining interest in terms of the increasing the renewable energy resources all over the world. The projects pay attention not only to the effects of ecosystems and land contour, but also to the effective and reasonable usage of natural resources. Different geothermal areas and projects are needed, potential project scenarios and their related laws and regulations depend on different environmental effects.

Environmental impacts differ depending on the type of the geothermal field and the application. In general, geothermal development will also have socioeconomic impacts with physical, chemical and biological impacts in environmental perspective. The importance socioeconomic impacts for decision, planning and management processes in geothermal developments are determined by international agreements, protocols and laws. The measurements of socioeconomic parameters are needed in environmental impact assessment studies.

In this study, environmental impacts of geothermal application will be examined in socioeconomic title and specifically in Balcova Geothermal District Heating System (BGDHS), Turkey. The system is the largest district heating system of Turkey and has been very attractive to the settlers of Balcova town in Izmir City. It is quite interesting to observe the socioeconomic impacts of the system since 1996.

1. INTRODUCTION

The concepts of economic changes of geothermal development projects (GDP) are very important and the socioeconomic analysis is the other base point in these situations. There are some determinants about these changes; for economic changes: (1) increased employment and secondary trades with corresponding increase in per capital income, (2) reduction in resource base, (3) change of life style from rural to industrial/ economic setting, and for institutional changes: (1) cultural adoption (enables cultural communities to participate in national development), (2) population changes in composition and number due to induced development leading to pressure on resource base, (3) effects on aesthetic and human interest areas (scenic vistas, open space qualities, unique physical features and archeological sites, e.g. Brown**,** 1995).

The socioeconomic analysis is a major key subject in GDP because the socioeconomic situations of the populations living in the case area are very important determinants for environmental impacts of geothermal developments. Socioeconomic situations of the population living in geothermal fields, both before and after the launch of geothermal district heating system, are important issues for GDP.

In general, geothermal development projects include improving the socioeconomic conditions. Improving the socioeconomic conditions of the GDP is the remarkable input of the project, e.g. Jesus (1995). Socioeconomic parameters may change according to the scale of the project. Certain parameters or determinants are measured for the purpose of evaluating the effect. These can be stated as demography, type of living, needs and problems, housing and municipality services (running water, sewerage, electricity) and sociopolitic organization (the structure of the municipality, political relationships, volunteer organizations), e.g. Brown (1995).

According to Jesus (1995), the goal of the socioeconomic analysis of the GDP is to explain the change in the study areas where are not affected by direct and indirect impacts of the geothermal project. Geothermal analysis obtains a guide on how the geothermal project can be kept in consonance with the sociocultural and economic situations in the area.

Within the scope of this study, significant contributions appear in the literature concerning geothermal energy into socioeconomic concepts. For these socioeconomic literature examples, the main reason for selecting these two projects of socioeconomy and geothermal energy relations from Kenya and Greece was the fact that data collection and questioning methods, as used by land and questionnaire studies performed in the section of socioeconomical analysis and described all relevant parameters, have similarities with socioeconomical analysis and GDHS literature. In the Kenya study, e.g. Mariita (2002), the socioeconomic survey analysis method for environmental, cultural, health impacts and general attitude factors were used in Maasai case area. In the Greece study, e.g. Manologlou et. all (2004), the statistical data collection process survey method which is capable of reflecting experts' method was used for Milos Island.

Balçova district was chosen as a case study area. There were many factors for choosing this area; (1) to extend the long period data because of being the oldest and the biggest district heating system in Turkey, (2) due to various already conducted research studies available about Balçova district heating system by related institutes and universities, (3) due to protocols about open research in this system between İzmir Geothermal Incorporated Company and İzmir Institute of Technology.

2. BALÇOVA CASE AREA

Balçova is one of the nine districts in İzmir. Balçova is surrounded by Konak district to the east, Narlıdere district to the west İzmir Bay to the north. The district has a 6 km long natural beach, in addition to Cengiz Saran dam and 5 brooks (with the names Yahya River, Sarıpınar River, Hacı River, Molla Kuyu River and Ilıca River). Because of the hilly landscape in the north the settlement took place toward the east and the west.

The geographical location of the district facilitates the traffic as well. With the construction of a new motorway, the distance between Balçova and Adnan Menders Airport shortened to only 15 minutes. With the pier in Üçkuyular and the yachting port the connection by the sea route and the road connections, Balçova is situated in the center of an important place.

Balçova district, which is between Konak and Narlıdere districts, lies in the boundary of İzmir Greater Municipality. There are eight neighborhood in this district; Korutürk, Onur, Eğitim, Çetin Emeç, Fevzi Çakmak, Teleferik, İnciraltı and Bahçelerarası neighborhoods.

2.1 Socioeconomic Structure

Balçova district is a tranquil, safe and reliable region and it is predominantly residential and planned area. Especially, retired people and university students prefer to stay in Balçova district. Generally, there are apartment blocks. On the other hand, single and garden buildings are seen where high income level people live, there are some special settlement sites, such as İş Bank sites in the centre of the settlement.

In addition, there are city hotels such as Crown Plaza, Princess Hotel, Balçova Thermal Hotel, big shopping centers such as Özdilek, Agora, Palmiye, Balçova Migros, Balçova Kipa, Balçova Koçtaş and Balpa, İzmir Economy University and faculties of Dokuz Eylül University, a regional entertainment park - Balçova Aqua city Park -, a thermal cure centre - Balçova Thermal Cure Centre -, are all situated in Balçova district**.**

2.1.1 Agriculture, Industry, Commercial and Tourism Structure

According to Balçova Municipality and İzmir Agriculture Head Office data, in 2007, the total area of Balçova district is 2890 hectare and total agricultural areas are 550 hectare (383 hectare of them are watered). There are 107 hectare of vegetable areas, 64 hectare of flower greenhouses, 10 hectare of vineyard areas, 5 hectare fruit gardens, 199 hectare of citrus tree areas, 130 hectare of olive tree areas and 15000 olive trees, 35 hectare suitable agricultural areas are present in this district. And there are 144 glass panel unit greenhouses in 14.6 hectare areas, 541 plastic unit greenhouses in 57.6 hectare areas, Arkoc (2006).

There are no high- and middle-scale industries in Balçova district mentioned in literature from the Chamber of Industry in İzmir. Usually, automobile repair shops, furniture workshops and metal workshops are settled in the light industry site which has 100 units and 16500m^2 areas, in Balçova, and small commercial units are prevalent areas in Balçova district, Arkoc (2006).

The Dede Mountain (500m) in height is the south side of the district, the Balçova seaside the north side of the district is the origin of the natural attractiveness of the tourism sector in Balçova. Forests and thermal water sources can be added to the morphological aspects of the region. There is the Cengiz Saran Dam in the south of the Ilıca River and it lies inside the forest area. All of these give some help to the tourism development, but the major factor of the tourism is Balçova Agamemnon Thermal Spring. Both native and foreigners use the thermal cure centre for health problems, Arkoc (2006).

2.1.2 Education Structure

There are eight elementary schools with a total student population of 6363, five high schools with a total student population of 2101, and a neighborhood education center in the Balçova district, e.g. BLG (2007).

2.1.3 Health Related Facilities

There are 5 unit small scale healthy centers, an outpatient clinic, and a family health center in this Balçova district local area. On the other hand, the city scale high capacity healthy institutions stay in Balçova district; Research Hospital which is the name of Dokuz Eylül University Faculty of Medical Science, Dokuz Eylül University, Physical Cure Centre and Rehabilitation High School, Balçova Thermal Cure Center and Rehabilitation High School, SSK Balçova Clinic. In addition, a lot of special healthy centers have started to build around Balçova.

2.2 Geothermal Reservoir and System Features

BGDHS is the largest neighborhood/district heating (DH) system in Turkey, both planned and implemented (see Fig. 1). The first phase covers heating of 10000 residences. After completing the first phase, geothermal district/cooling will be applied in the second phase. The large-scale neighborhood heating application came to Turkey with geothermal energy. The first large-scale neighborhood heating system was put into operation in Gönen-Balıkesir. Before the utilization of geothermal energy most of the central heating applications were the governmental office buildings, block apartment – in which most of the families in Balçova live – and hospitals, which may be labeled as "space heating" rather than "neighborhood heating".

The energy obtained from the geothermal source in Balçova is used for heating of the houses, for hot water, heating of the greenhouses and for thermal health tourism. The geothermal system consists of 5 heating centers, 1 pumping station, 3 sub-heating center, 16 production well, 3 reinjection wells, 4 observation wells and approximately 200 km. of pipeline**.**

12000 subscribers, 6 greenhouses, Geothermal Princess Hotel, Balçova Thermal Center, Özdilek Shopping Center and Crown Plaza Hotel, Inciraltı Atatürk Dormitories, İzmir Economy University, Dokuz Eylül University Hospital, Dokuz Eylül University Medical Science Faculty, Dokuz Eylül Conservatory, Dokuz Eylül University Fine Arts Faculty, use geothermal energy for heating and hot water. There are 11057 Residence Equivalent (RE) unit houses and small offices and 5965 RE higher capacity units (hospital, university, hotel etc.) in Balçova neighborhoods, in 2007 data.

In addition to house and work place heating, 600000 m^2 greenhouse areas belonging to private enterprise is also heated with geothermal energy. These greenhouses are used for agriculture such as floriculture, fruit-vegetables production. The thermal physical therapy and rehabilitation clinic enables 1500 patients to be cured each year.

Balçova Geothermal System reached 24500 RE system/installation capacity and 157 Megawatt-thermal capacity (20500 RE of which are the existing situation). It is expected that by the end of 2008, new systems using the existing wells will reach 31000 RE capacity (190 Megawatt-thermal).

Within the case study area, since 2002 5 development plan changes have been approved by the municipality for

different neighborhoods and Geothermal Heating Centers (GHC) were constructed after the plan changes. These changes were confirmed for different neighborhoods such as Onur-Fevzi Çakmak neighborhoods GHC in July 2005, Teleferik neighborhood GHC in May 2006, Korutürk neighborhood GHC in 2006, Fevzi Çakmak neighborhood GHC in October 2006, and Onur neighborhood GHC in June 2007 (see appendices).

The second research was conducted within the Department of Real Estate in Balçova Municipality to determine the local land values in between 1997-2006 and to make the localization of these streets. The beginning year of the research, 1997, was accepted as the time when the geothermal energy was used in Balçova district for the first time.

3. DATA

Within the data collection and analyzing process "Case Study Method" and "Survey Method", e.g. Creswell (2003) are used. It is useful to consider the full range of possibilities for data collection in any study, and to organize this method, its use of closed-ended versus open-ended questioning, and its focus for numeric versus non-numeric data analysis.

In Balçova, it is difficult to obtain sufficient and correct data due to the observation of very few parameters until recent years. Therefore, all the archive data are collected from different public and private institutions and organization. These data which collapsed demographic and socioeconomic data, were collected by different related organizations and institutions about Balçova district. Especially, the data results which were prepared by General Directorate of Mineral Research and Exploration (MRE), General Directorate of State Hydraulic Works (SHW), Turkish Statistical Institute (TSI), Greater Municipality of İzmir, Balçova Municipality, Health Group Presidency of Balçova, Balçova Educational Directorate, Executive Offices of Neighborhoods, Non-governmental organizations, Local Real Estate Agents, Local Governor of Balçova, The Healthy Group of Balçova Local Administration, are added value to input in socioeconomic impact perspective.

In the data collecting and data analyzing process, site surveys and interviews are conducted within the six neighborhoods of Balçova district (Korutürk, Onur, Fevzi Çakmak, Teleferik, Eğitim and Çetin Emeç Neighborhoods) aiming to get data about the buildings and their relation to land-use plan. For the purpose of collecting data for socioeconomic analysis, questionnaires (face to face interview technique) have been conducted focusing on collect the existing data from local administers and government agencies, and also previous studies data is utilized.

The structure of the questionnaire is based on two thematic parts defined by 30 questions and 1 table. It consists of factual questions, opinion questions and open-ended questions. The factual questions refer to demographic and social characteristics of the interviewees such as location; gender, educational level, and occupation.

The opinion questions form the core of the questionnaire, as it is on those on which the fulfillment of the goals of the investigation will be mainly be based. They include questions enabling the assessment and documentation of the effects of the concentration and operation of the desalination unit on (1) the day-to-day life of the local community, (2) the economic and productive activities in the Balçova case area and (3) the physical environment. The open-ended questions are used in order that the interview can freely articulate their views on the issues being investigated.

In this context, the face to face interview and questionnaire (open-ended) data collecting system was used for 486 sampling households (2% sampling rate) in Balçova district. "Random Sampling" method is used during questionnaire studies applied in the study region; taking samples from each street at specific quantities. The results of the surveys formed a database and are extensively analyzed after tabulating on a thematic basis. As far as the primary data processing is concerned, the "SPSS for Windows" software is used. This number of samplings was separated with rate of total houses number of neighborhoods (Koruturk neighborhood: 88 sampling, Onur neighborhood: 143 sampling, Fevzi Çakmak neighborhood: 81 sampling, Teleferik neighborhood: 55 sampling, Çetin Emeç neighborhood: 36 sampling, Eğitim neighborhood: 83 sampling). The case area are separated in three parts; using the BGDHS in settlement (Koruturk and Teleferik neighborhoods), partial using the BGDHS in settlement (Onur and Fevzi Çakmak neighborhoods) and not using the BGDHS in settlement (Çetin Emeç and Eğitim neighborhoods).

For these chosen areas, the socioeconomic data were collected in two different groups; the questionnaire for all individuals in all sampled households, the questionnaire for only one person representing the whole household. The first questionnaire type include the general socioeconomic structure of the household about number of household size, living period in Balçova district, sex, age, educational level, employment situation, social safety and income level of sampling households.

The second questionnaire type include the two related subjects; the measurements of structural and legal situations of building where sampled population live, and the measurements of thoughts and expectations of households about geothermal energy, technical and political investments of BGDHS, advantages and disadvantages of the system and deficiencies of the geothermal system.

Socioeconomic data/parameters for case area in Balçova district:

A. the household analyses of all members of a household,
    1. the measures of general socioeconomic condition,
        a) the number of household population,
        b) living time in case area,
        c) sex,
        d) age,
        e) educational level,
        f) occupation,
        g) social safety,
        h) income level,
B. the household analyses only a household;
    1. the measures of general specifies of building in where household live;
        a) the age of building,
        b) size,
        c) permit situation,
        d) host owner/ tenant position,
        e) technical infrastructure (especially, geothermal infrastructure system),
    2. the measures of household's perceptions about geothermal energy and system;

a) the pleasure from geothermal energy,
b) the relationship between geothermal energy and reason of living in there,
c) the knowledge about neighborhood heating system,
d) the use frequency of facilities,
e) the changes in populations and employment, real estate and land values after utilization of geothermal district heating system,
f) the complaint or the negative effects from geothermal development
g) the positive results of geothermal development,
h) the expectations from Balçova geothermal district heating system (BGDHS).

4. RESULTS

Results of data analyses which were conducted depending on the socioeconomic surveys were evaluated separately for each district of the town in the direction of main titles formed during the process of surveying. General socioeconomic situations, technical and legal situations of houses and expectations about BGDHS were examined on the sample and the relationship of the people living in the district with the BGDHS was revealed.

4.1 General Socioeconomic Indicators of Population

Within the sample study area, the geothermal energy district heating system was established with its entire infrastructure in Korutürk and Teleferik neighborhoods. Onur and Fevzi Çakmak neighborhoods are established in several ratios in neighborhoods. In Çetin Emeç and Eğitim neighborhoods, no district has been heated. Consequently, giving study results based on the neighborhood gave us information on neighborhoods which do and do not use geothermal energy.

In the limited number of studies that appear in literature on geothermal energy and its effects, this sort of data was examined to a certain degree in a socioeconomic concept study in the Kenya study, Mariita (2002), while general socioeconomic data were not examined in this way in the study on Milos island, Manologlou et al. (2004).

The results obtained from questionnaires were examined in terms of subjects.

4.1.1 Household Size

Family size is an important factor especially when determining the number of people making use of geothermal energy. In underdeveloped countries such as Kenya, Guatemala, and Philippines, geothermal energy is given special care as government policy for use in district heating in neighborhoods which can be considered as shanty shows that it has got important political outcomes since the family sizes are really big and so is the number of users in these areas. Especially in a study conducted in Kenya, families with the average a size of 19 people were encountered, Mariita (2002).

In Korutürk neighborhood, which is to the west of the study area, in a family size survey encompassing 88 families, household size ranged from 1 to 7, a value of 3.23 was found as an average family size.

In a study of questionnaire in the neighborhood, family size was found to be 3.24. Minimum and maximum family sizes were observed as 1 and 7 respectively. According to the 2007 data taken from Health Group Presidency, this value is 2.97.

In Fevzi Çakmak neighborhood, as a result of a survey of 81 families, 3.29 was found to be the average family size. Minimum and maximum family sizes were observed to be 1 and 6. The data of Health Group Presidency shows the value of 3.14 as the average family size.

Average family size in another neighborhood, Teleferik neighborhood, 3.31 in a sample size of 55 families, this being a close value the 3.29 which is a value found in 2007. This value being close to the 2007 value is due to the fact that Teleferik neighborhood has a younger population than the previously mentioned ones and this may be the result of the fact that the number of people spending summer months elsewhere is smaller. Minimum and maximum family sizes were obtained to be 1 and 6 in this neighborhood.

In the survey conducted on a sample size of 36 families in Çetin Emeç neighborhood, average family size was found to be 3.9, minimum and maximum being 1 and 6 respectively. In 2007 data of Balçova Health Group Headship this average is 3.11 people.

Finally, from the sample size of 83 families in Eğitim neighborhood, average family size was found to be 3.15, this being 3.05 in the data of Balçova Health Group Headship. Minimum and maximum values were found to be 1 and 7 people.

Although the examination of the results shows little difference from those of previous ones, as an area in which geothermal energy is used in heating system, this value is under the average of both İzmir and Turkey in general. Although this result is observed as positive at first glance, in the context of BGDHS, it comes up as disadvantage in terms of the number of people making use of this system (see Fig. 2).

4.1.2 Age and Sex Structure

Although there is not a one to one relation between age and sex and BGDHS, it may give us detailed information about the neighborhoods making use of BGDHS (see Fig. 3).

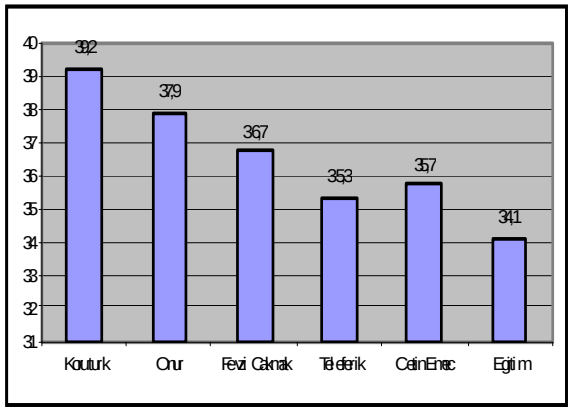

Figure 3: An average age situation for case area in Balçova district.

4.1.3 Educational Level

Jesus (1995) stresses the fact that the ratio of acceptability of the geothermal projects rises as level of education in public opinion and people living in geothermal regions increases. Consequently, the level of education bears value especially in providing the people's participation in projects.

Following this approach, when one looks at the study on the level of education, the following graphic comes into being in Koruturk, Onur, Fevzi Çakmak, Teleferik, Çetin Emeç and Eğitim neighborhoods (see Fig. 4).

4.1.4 Employment and Income Level

Income levels and work branches of the people living in regions where geothermal projects are applied is an highly important factor because in geothermal energy district heating systems, the highest cost, which especially occurs during infrastructure works, is reflected to the users as the initial cost. For this reason, in areas where people are capable of affording these costs, development of these projects can take the priority. As a result of sample size studies in neighborhoods in Balçova, the following results were obtained (see Fig. 5).

There is uncertainty in this section that the values found for average household incomes reflect reality. Especially in this evaluation which was realized depending on individuals own statements, it was concluded that insufficient information was obtained about real estate incomes of the people.

The fact that the ratio of unemployment is low brings forward a different example compare with those developments in underdeveloped countries. Alongside this fact, there exist certain material difficulties in that local governments convey the cost to users.

4.1.5 Social Assurance

Social safety, another variable of socioeconomic structure, is directly related to the fact that people living in those areas adopt and support geothermal projects. Since social safety is related to job, work force and income situation, supporting ratios of those who have social safety is high.

In this context, when neighborhoods were examined in the sense of samples in the study area, it was observed that the percentage of those belonging to SSK (the Institution of Social Insurances) was 50% - 65%, that of those belonging to Emekli Sandığı (Government Pension Fund) was 12%-30%, Bağ-Kur (Retirement Institution for Freelance) was 11%-20% (see Fig. 6). The number of those belonging to private insurance system is very low and the ratio of the uninsured is 10%.

4.2 Technical and Legal Situation of Buildings

The sample study which was conducted taking responses from one person in each family in the study area is related with physical state and properties of the families. In this study, sample study was realized in six different neighborhoods and it was gathered together in five titles. These titles are building age, size of the house, ownership situation, value of the building, use of geothermal energy, and the situation of technical infrastructure within the cost of the energy type the family uses.

4.2.1 Building Age

When the ages of the houses in the sample area were examined, it was observed that they could be gathered in the age group of 20 to 25 (see Fig. 7).

There was an average 22.1 age of houses in Korutürk neighborhood, 23.5 age of houses in Onur neighborhood, 22 age of houses in Fevzi Çakmak neighborhood, 21.5 age of houses in Teleferik neighborhood, 21.2 age of houses in Çetin Emeç neighborhood, 24.2 age of houses in Eğitim neighborhood.

4.2.2 Building Size

The size of the building has an important role in BGDHS. The “Residence Equivalent” concept formed by the firm to construct the geothermal system ($100m^2$) shows difference with the existing housing texture. So the ratio of units used for the purpose of heating with geothermal purposes in the district calculated on the basis of residence equivalent shows in fact how many of the houses use geothermal energy (see Fig. 8).

4.2.3 Building Ownership Situation

The fact that the number of building owners in the study area in general is high is a positive indicator in terms of the use of geothermal energy. It is compulsory that the land owner sign a contract with the municipality for geothermal heating for the buildings within the BGDHS in Balçova (see Fig. 9).

4.2.4 Building Value

If it is to show the average building values respectively in the sample examination in the study area; average value of building was 18600 Turkish Liras (TL) in Korutürk neighborhood, 176000 TL in Teleferik neighborhood, 149000TL in Fevzi Çakmak neighborhood, 138000 TL in Çetin Emeç neighborhood, 134000 TL in Onur neighborhood and 119000 TL Eğitim neighborhood (see Fig. 10).

4.2.5 Geothermal Energy Use

In two of the neighborhoods involved in the study area (Korutürk and Teleferik neighborhoods), the structure of BGDHS was already established. It was determined that infrastructure in two more parcels were completed during the course of this study. Although a large portion of the system has been completed, it does not mean that all people living in this district have been connected to the system (see Fig. 11).

It was observed that 78.8 percent of the people have already been connected to the system. Although there are apartments in a percentage of 21.2 in the same area, there is also a group that does not use geothermal energy. There is a certain group in these two districts that live in an apartment system but do not yet have geothermal energy connected to their apartments. The reasons for this will be examined under the next title. The geothermal heating system that can reach to certain areas in Onur and Fevzi Çakmak neighborhoods, we came across users to a percentage level of 34.8% and 32.1% respectively, and those who do not use the system range in 7.6% and 18.5% respectively. There are buildings in which the system has not been installed yet; these constitute the percentage levels of 57.6% and 49.4% respectively.

4.2.6 Energy Use Types and Costs

A study has been conducted to see determine the average cost in areas using geothermal energy, and what kind of energy is used and what its cost is in areas not using geothermal energy. As a result of this study, pollutant energy resources are also used in Balçova where clean energy is known to be used, and it has been investigated what sort of outcomes occur when compared with the use of geothermal energy.

Although the use of thermal energy in general is prevalent in the neighborhoods of Korutürk and Teleferik, the use of air conditioners and electric stoves is at a limited level (Korutürk 13%, Teleferik 26%). Air conditioner and

electric stove use for the purpose of heating takes the first rank in Onur and Fevzi Çakmak neighborhoods (Onur 43%, and Fevzi Çakmak 35.7%). Geothermal takes the second rank (Onur 34.8%, Fevzi Çakmak 32.1%).

For Çetin Emeç neighborhood, wood and coal takes prominence for heating purpose (46.6%). In the second rank comes air conditioner and electric stove (34.5%) and in Eğitim neighborhood, it was observed electric stove and air conditioner for heating purpose is (50.6%) and in the second rank, coal is (43%), (see Fig. 12).

A research conducted on heating costs in the study area in general, was determined that the cost of heating with coal or wood was approximately 75 YTL/month, heating with fuel-oil is 107 YTL/month, the cost of heating with electric stove or air conditioner was 74 YTL/month, and finally the cost of heating with geothermal energy was 55 YTL/month (see Fig. 13).

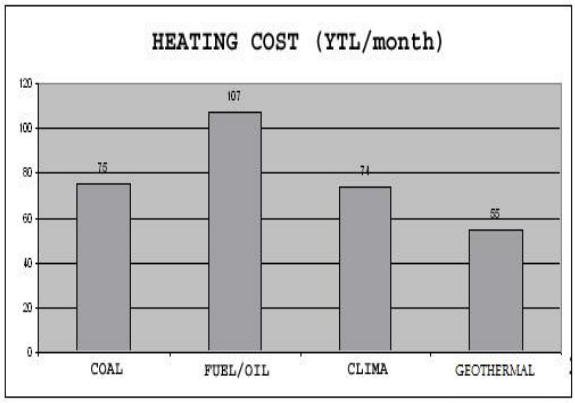

Figure 13: The average heating costs for case areas in Balçova district.

In Balçova, which was determined as a clean energy district, it was observed that the use of wood and coal for heating purposes is common because the use of geothermal energy has not yet been made common. In the current study, in which advantage was observed for the geothermal energy, it is thought that BGDHS becoming widespread will be preferred in general.

4.3 Expectations about BGDHS

In the light of information obtained from the sample about residents' general socioeconomic situation and the houses they live in, emphasis was given to learn whether they have sufficient knowledge about heating, whether they benefit from geothermal energy, and what their expectations were about advantages and disadvantages of geothermal energy.

Corrections were made fewer than three main groups during the current study; in the first group, effort was given to learn the residents' accumulation of knowledge. In this context, the reason of people's moving into the neighborhoods in Balçova and the degree of effectiveness of geothermal energy in this matter, and on what purposes other than heating geothermal energy is used. In the second group formed in this analysis, the state of using thermal energy, and in case thermal energy does not exists, what its effects are in place and economic sense. The state of making use of the installation in the vicinity and using thermal energy for heating purposes in Balçova, effects of it on population, new job opportunities, real estate prices and real estate ownership took place in this group. Finally, positive and negative effects of geothermal energy on the district were examined.

4.3.1 The Reason of Moving in Balçova

Whether or not thermal energy exists among the reasons why the residents moved into this district is an important criterion at least in the sense whether or not people are aware of the existence of the thermal energy. In the framework of this analysis, two different opinions of the interviewers were called upon. In the first part, the cause of their moving into the district was asked without giving any choice, in the second part, they were asked whether the existence of geothermal energy had any effect in their moving into the district.

Taking part in the first section for the causes of moving into the district, nine different reasons were thought of. These choices were formed depending on their responses; real estate prices or rents being low, existence of geothermal energy, relatives or friends living in the vicinity, existence of natural beauty, and the purpose of investment.

In a speculation in which a person can give more than one answer, the choices that there are different natural aspects in six different neighborhoods, relatives and friends being in the vicinity and the district being close to business centers came to the fore. While geothermal energy existed at certain degrees in neighborhoods of Korutürk (21.2%) and Teleferik (19.6%), it came at the back plan in other neighborhoods; Onur neighborhood is being at the 5th rank, Fevzi Çakmak neighborhood being at the 8th rank (see Fig. 14).

Evaluating the results of this study, it was found that the people living in this district moved here for other reasons than the existence of geothermal energy but they concluded that where the geothermal heating system was installed they considered it as the main reason for their existence. Step by step progression of this system, which has been in operation since 1997, the fact that the starting area is Korutürk neighborhood and that the residents of the district considered geothermal energy as the main cause of their existence can be considered a development in a short time interval.

4.3.2 Willingness to Move Out

Whether or not there is a relation with geothermal energy among the causes that the residents of this district wanting to move out of this district also formed the speculation of this study (see Fig. 15).

4.3.3 The Utilization Levels of Geothermal Energy

According to the sample, the subject of how much of the ways of making use of geothermal energy is known again can be accepted as the way of adopting and participation geothermal energy use can be used as a criterion. Knowledge and interest of the residents can be used as a base for studies to be conducted in this district.

In this context, in the study conducted in six neighborhood, people' statements were evaluated without giving any clues and groping was made according to the replies obtained. In the light of results obtained, the people who do not have any information about geothermal studies were very limited in number (see Fig. 16).

4.3.4 Utilization of Geothermal Energy Facilities

In the current study, to what extend the existing geothermal installation is utilized by the resident has been examined.

Interest of the public in geothermal energy would be beneficial in that local and national agents will follow the studies and the people will get foreknowledge through these agents (see Fig. 17).

It was observed that residents made use of thermal installation in the vicinity at a limited level for building heating, hot water use in houses. The cause for this limited usage of the geothermal energy might be that local and national press did not show sufficient interest in the matter. The fact that informing people is not sufficient could be an important point in the present situation.

4.3.5 The Changing of Population Structure

People answered differently to the question whether or not there was any change in population, work, employment, real estate ownership and value after geothermal energy had begun to be used in the district. First, as a common opinion it was stated that there was an increase in population and real estate prices. In other choices, the differences in the area cause people to give different answers. In neighborhoods where thermal energy is used in buildings (Korutürk, Teleferik, Fevzi Çakmak and Onur neighborhoods) answers in relation with the increase were high. In Eğitim and Çetin Emeç neighborhoods, it was observed that there occurred not much change (see Fig. 18).

It was learned clearly that real estate prices increased after the use of geothermal energy in Balçova district (see Fig. 19).

With the use of geothermal energy in the district, very few positive answers were observed on the subject of employment increase and new job opportunities in Balçova district in general. New job opportunities did not occur at a ratio of 55% to 80% (see Fig. 20). Of the very few positive answers, much reflected the situation was not due to the geothermal energy but the new shopping centers opened recently in the district.

It was observed that there was an increase in general in the title deed ownership after the geothermal energy use had begun to be used (see Fig. 21).

4.3.6 The Positive Effects of Geothermal Energy

People living in the district touched on the issue that problems have decreased after the use of geothermal energy. Especially that air pollution disappeared, problems about business matters eased, houses begun to be heated more easily and the investment plans in the district were brought to the fore.

After geothermal energy came to the district, different results were reached on the subject of positive improvements among the neighborhoods: although positive results occurred in the decrease in air pollution in the neighborhoods of Korutürk (66.3%), Onur (56.4%), Fevzi Çakmak (48.9%) and Teleferik (68.8%), no change was observed in the neighborhoods of Çetin Emeç (48.9%) and Eğitim (59%), (see Fig. 22).

4.3.7 The Negative Effects of Geothermal Energy

According to the result of the survey, seven different problem titles are seen in the study area in general. These are noise during well boring, complaint about bad smell around wells, health problems of the people, problems arising from heating, shaking during boring, urban infrastructure problems and complaints about the construction company.

In general of the study area, especially during infrastructure work, infrastructure problems on the existing roads stands as a big problem. There seems to be approximately 50% infrastructure problem in each neighborhood (see Fig. 23).

5. CONCLUSION

There are some problems which are determined as major parameters/variables, about socioeconomic impact of geothermal development projects specific to BGDHS, can in fact be generalized to all other areas in our country; (1) local agenda, (2) community perception and interest on the projects, (3) NGOs' interest and (4) inadequate communication. The analysis of the existing situation and suggestions of changes for all parameters is expressed in detail as per project-plan-policy process.

Since the local press created *local agenda* which is the variable of the policy process, people have general information about BGDHS. However, some exaggerated information that appearing in local press causes local politicians to pursue opportunities and create great differences than general expectations. This causes the expectations of the local people to decrease and become indifferent to the subject matter. Although thermal energy district heating systems came forward in the agenda in İzmir, people are not aware that the system constitutes an example for other future considerations in the country. Separately, there is an accumulation of knowledge through overhearing. Informing people about the activities and aims, and furnishing with true and real information can be a solution for the creation of false agenda.

Despite the local agenda which is interested to a certain degree in geothermal development project, the problem of *community perception and interest on the projects* was determined. Attention and interest of the residents of BGDHS is very limited. Thus, there is a problem in people's participation in the matter. Although their knowledge on the fields of usage is limited, people living just around the zones where the system is established have a great deal of information about the geothermal system and its operations. İzmir Geothermal Co. which is the operator of the heating system, and Balçova Municipality are great stakeholders for BGDHS. When the project is checked, it is obvious that paying more attention on the project constitute participation force in this kind of spatial projects. In such studies, local government, firms, are as important as local agenda for getting the support local people. For this reason, importance must be given to informing the local people and establishing platform needed to share their expectations.

NGOs' interest in such projects is an example of significance. Generally, it is difficult to attract the attention of non-government organizations (NGOs) to such projects; however this had not been a problem in "BGDHS and geothermal development project". There has been the Association of Users of Geothermal Energy with 3000 members in this district for many years. This formation which is a great chance in the sense of participation is unfortunately an element of tension due to inadequate communication. There are problems between İzmir Geothermal Co. and the Association of Geothermal Energy Users which have been carried to court. Ineffectiveness of the project operators in drawing local people into the project underlines the importance of the NGO subject. Instead of creating mutual problems, NGOs should be integrated with the project and broaden participation as much as possible.

The variable of *inadequate communication* constitutes the basis of all problems mentioned above; problems confronted between the operator firm and local people, the operator firm and local civil organization, local government and press, local government and local people. Increasing the communication as much as possible, even establishing an organization in this mater can be a suggestion for solution.

ACKNOWLEDGMENT

We thank to the Scientific and Technological Research Council of Turkey (TUBITAK) for all supports to this research within the number of 104M301 Career Project.

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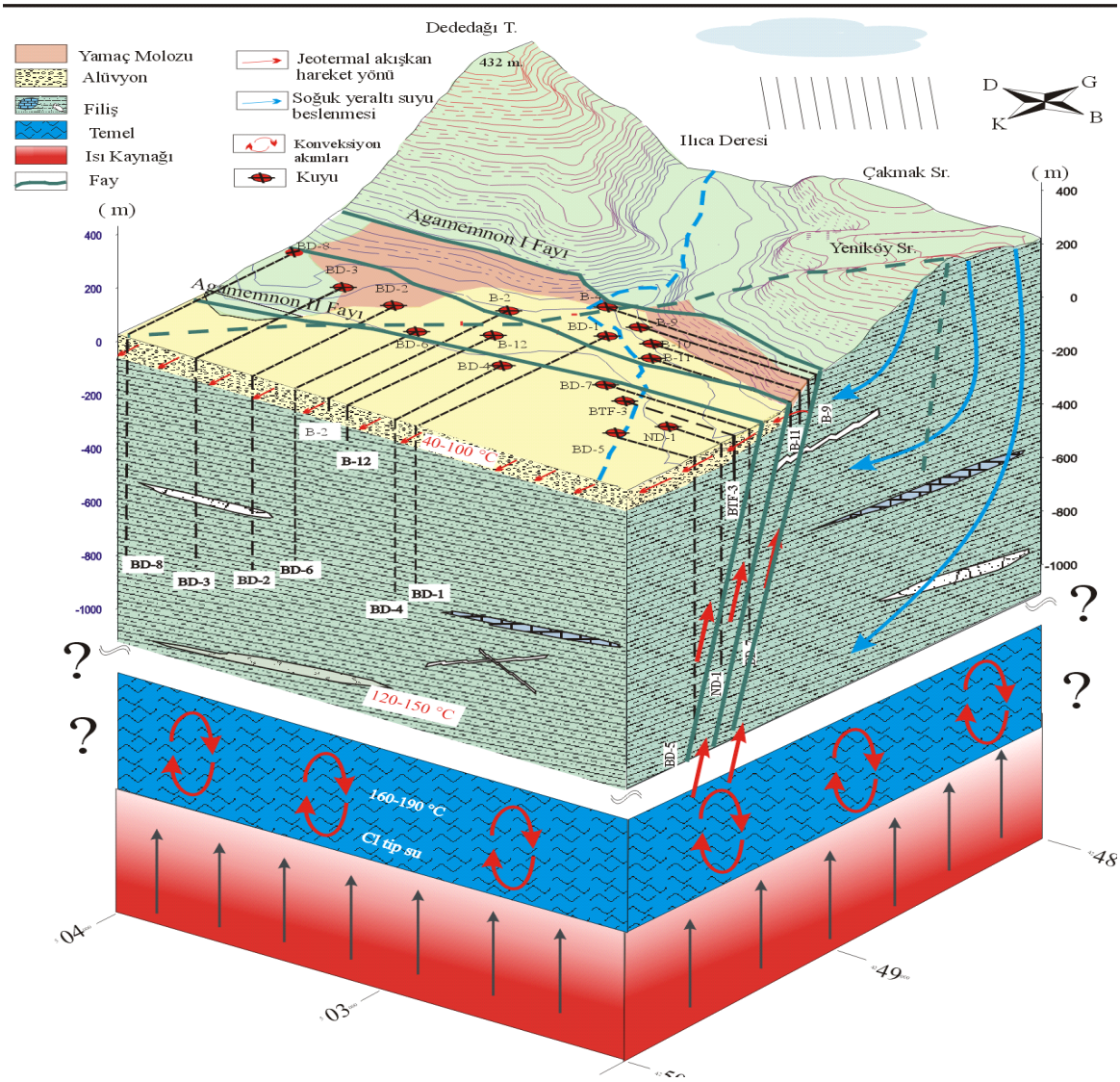


Figure 1: Geological maps of Balçova geothermal field (Source: Aksoy 2005).

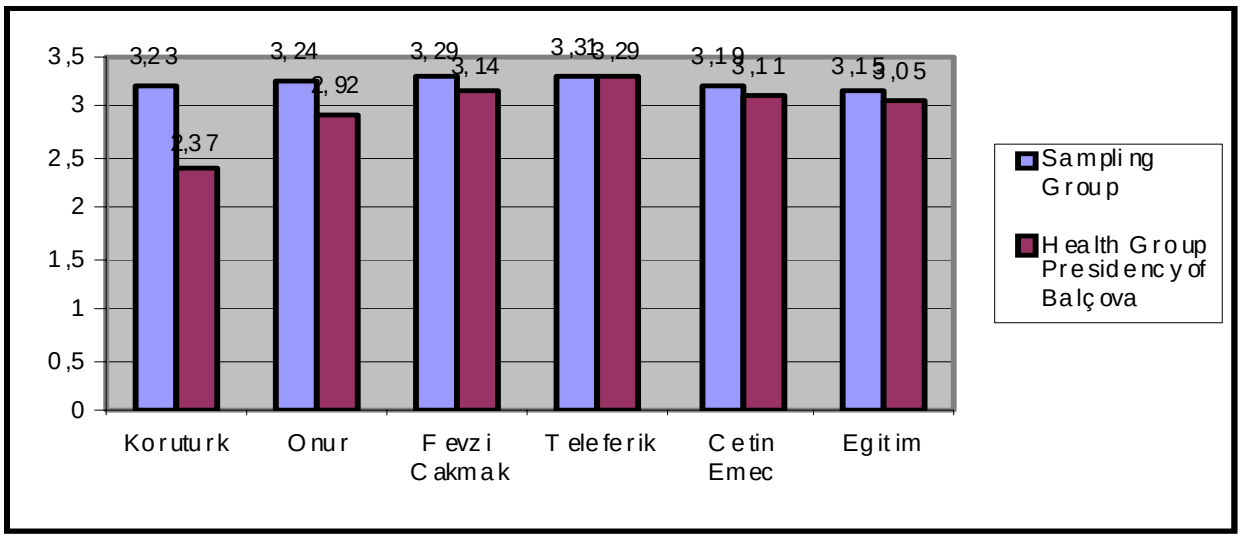


Figure 2: An average household size for case area in Balçova district.

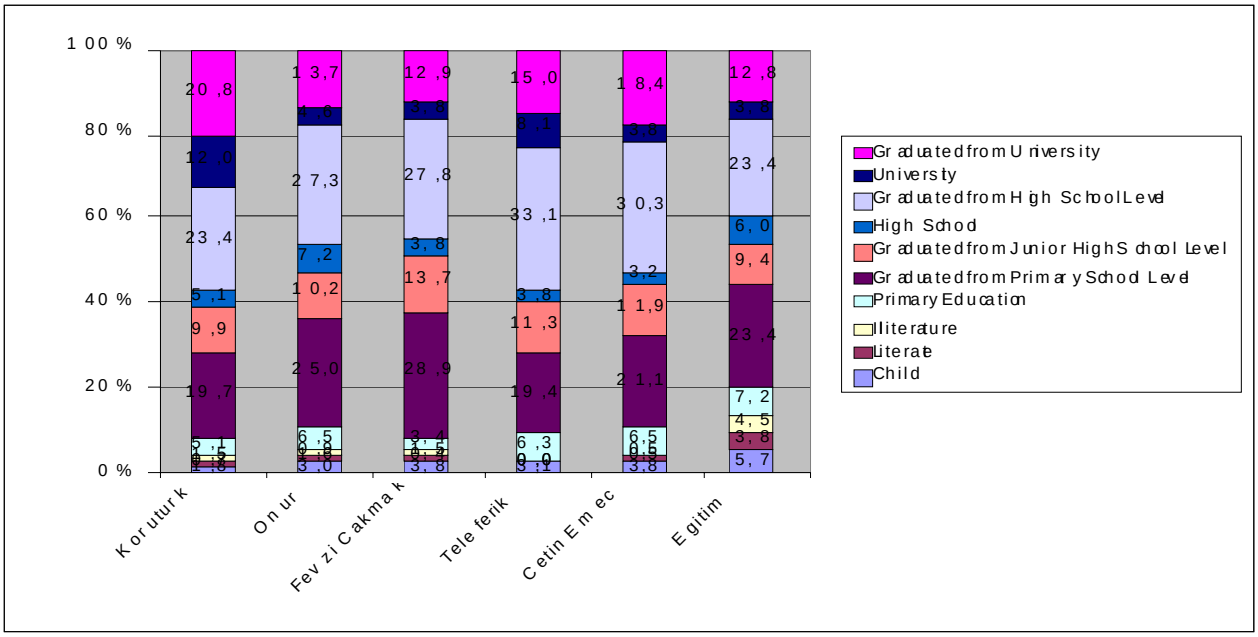


Figure 4: The percentage of educational level for case areas in Balçova district.

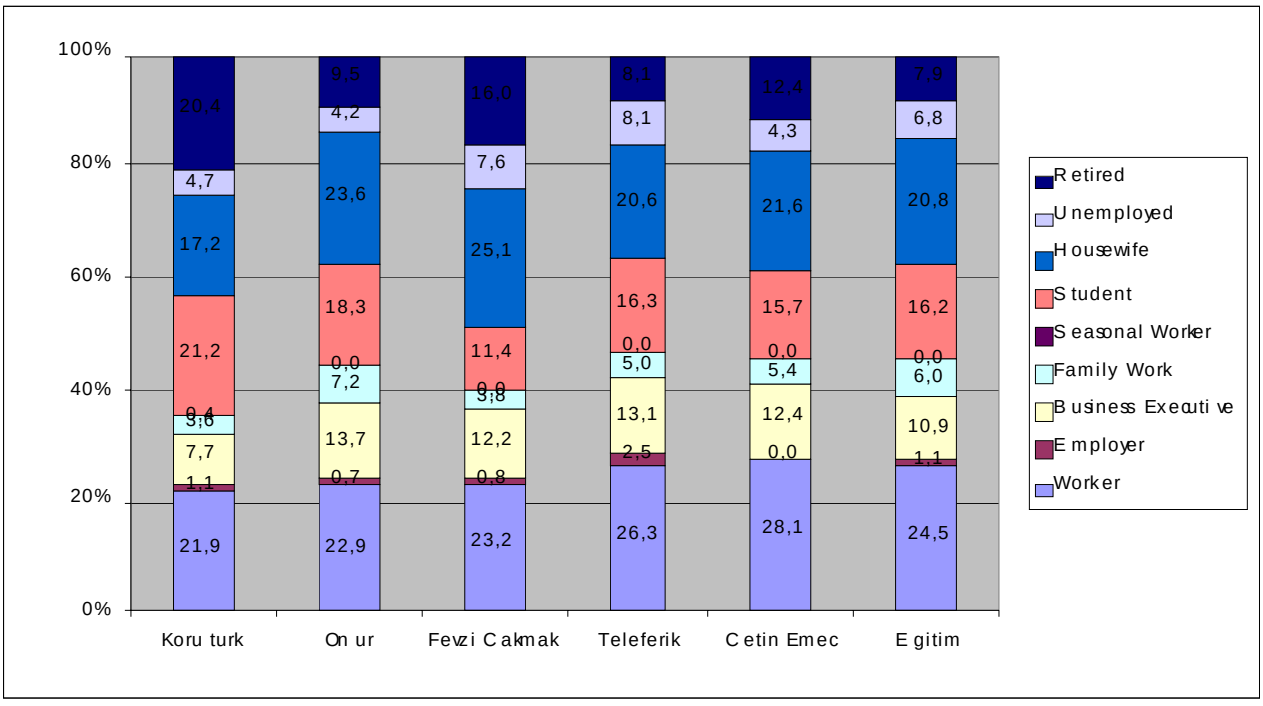


Figure 5: The percentage of employment level for case areas in Balçova district.

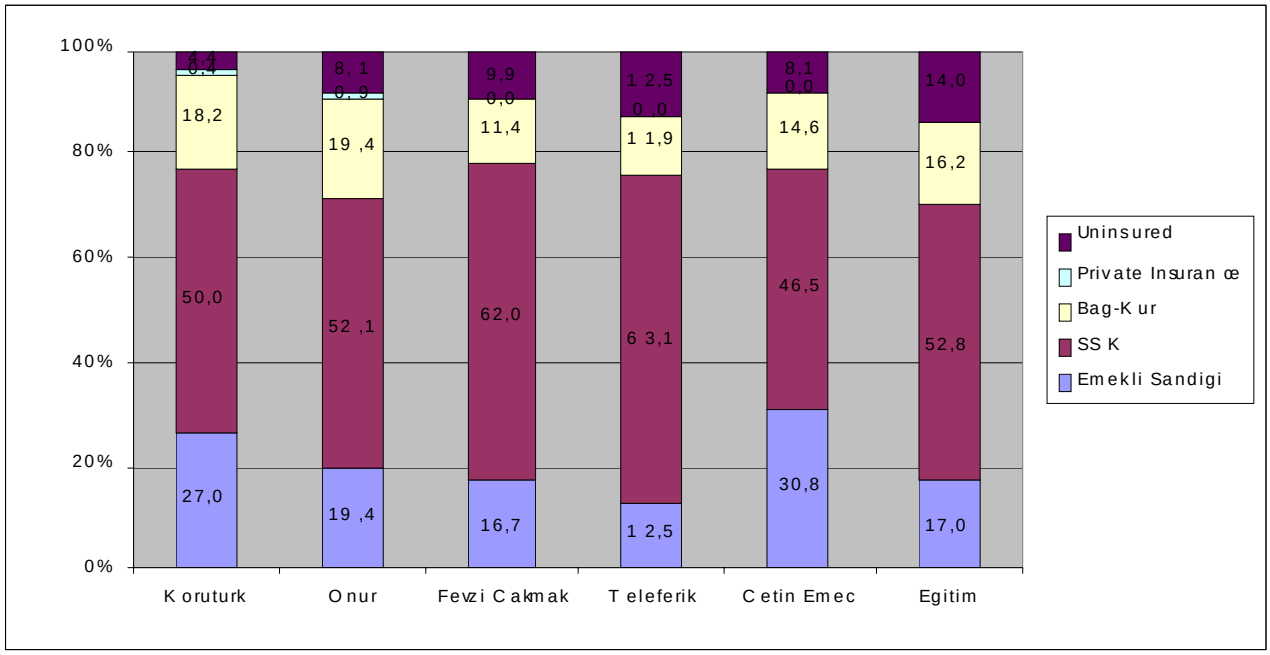


Figure 6: The percentage of social assurance situation for case areas in Balçova district.

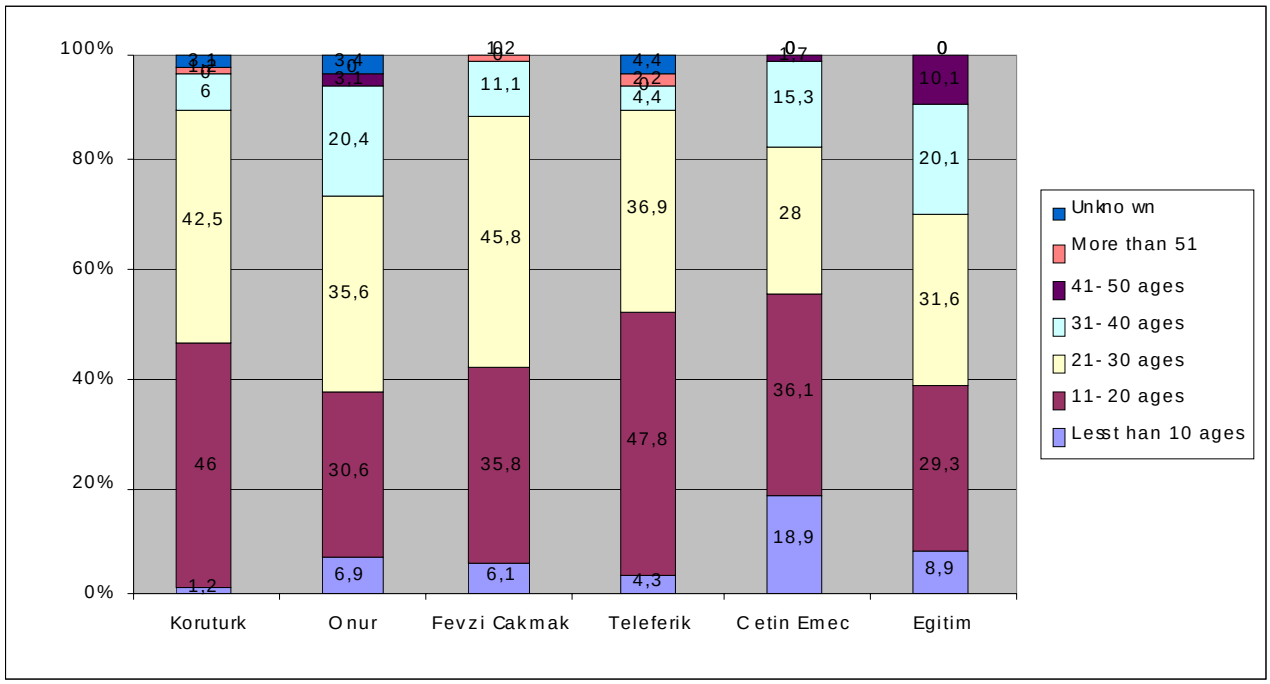


Figure 7: The percentage of building age level for case areas in Balçova district.

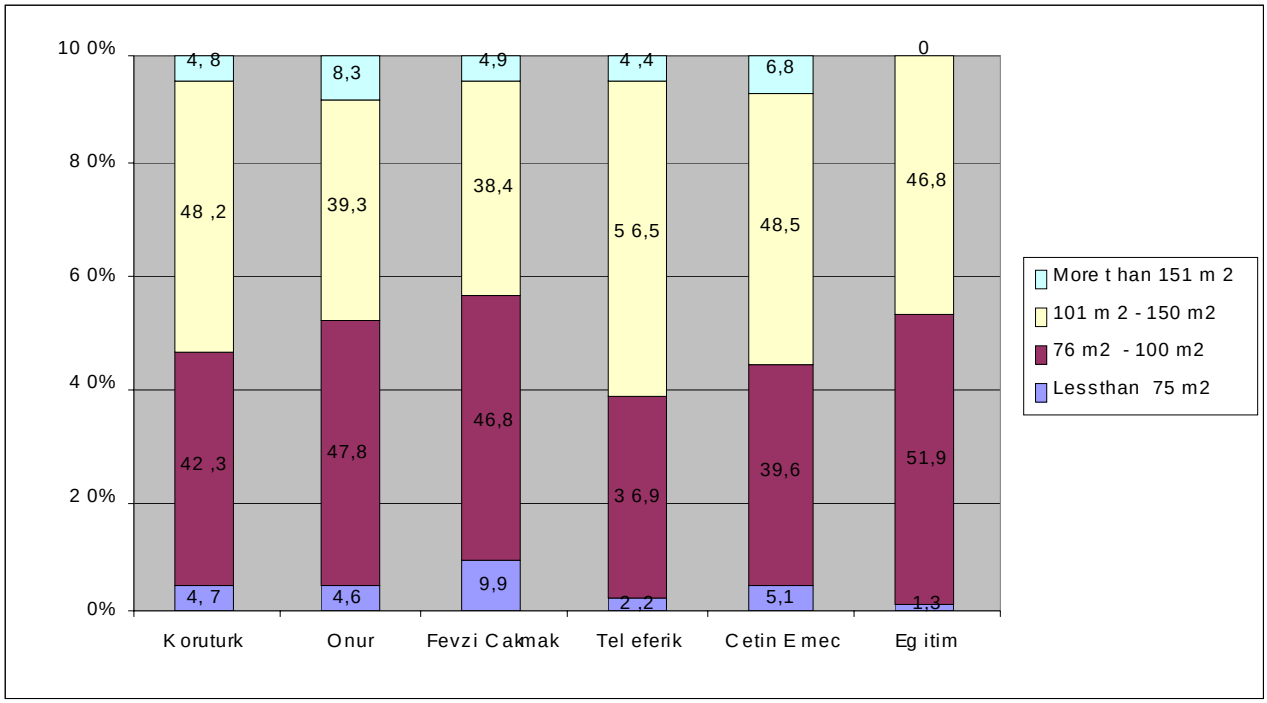


Figure 8: The percentage of building size for case areas in Balçova district.

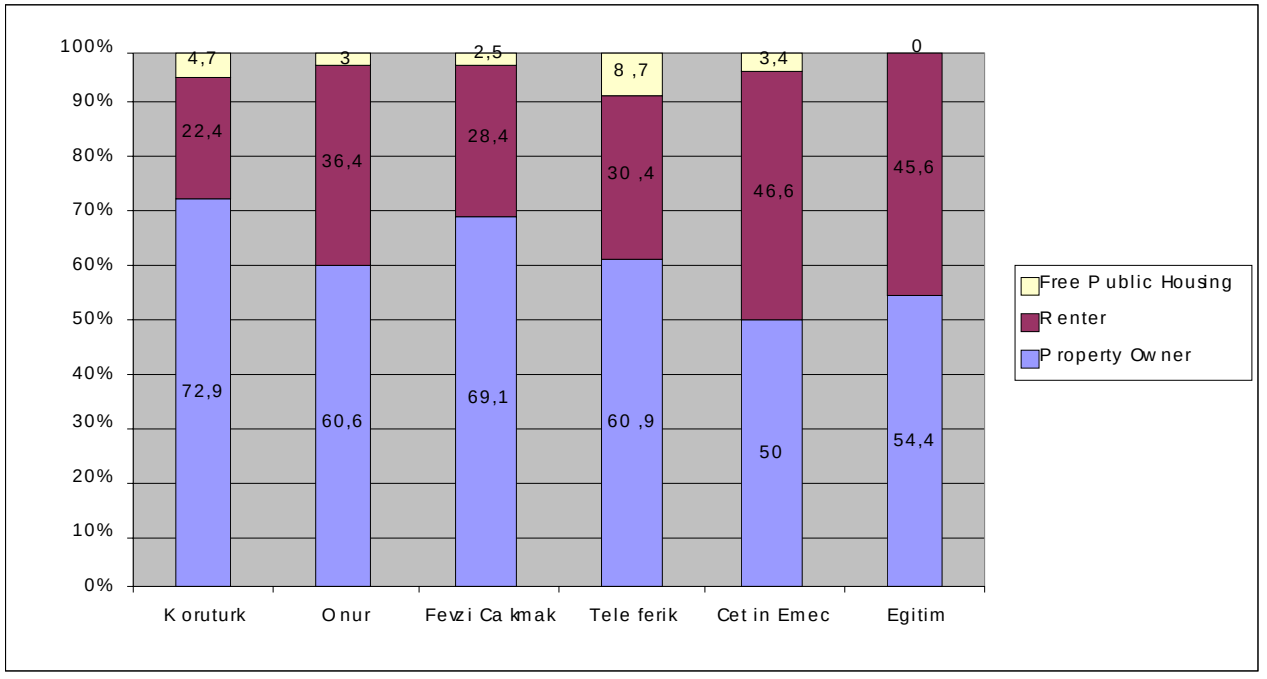


Figure 9: The percentage of building ownership situation for case areas in Balçova district.

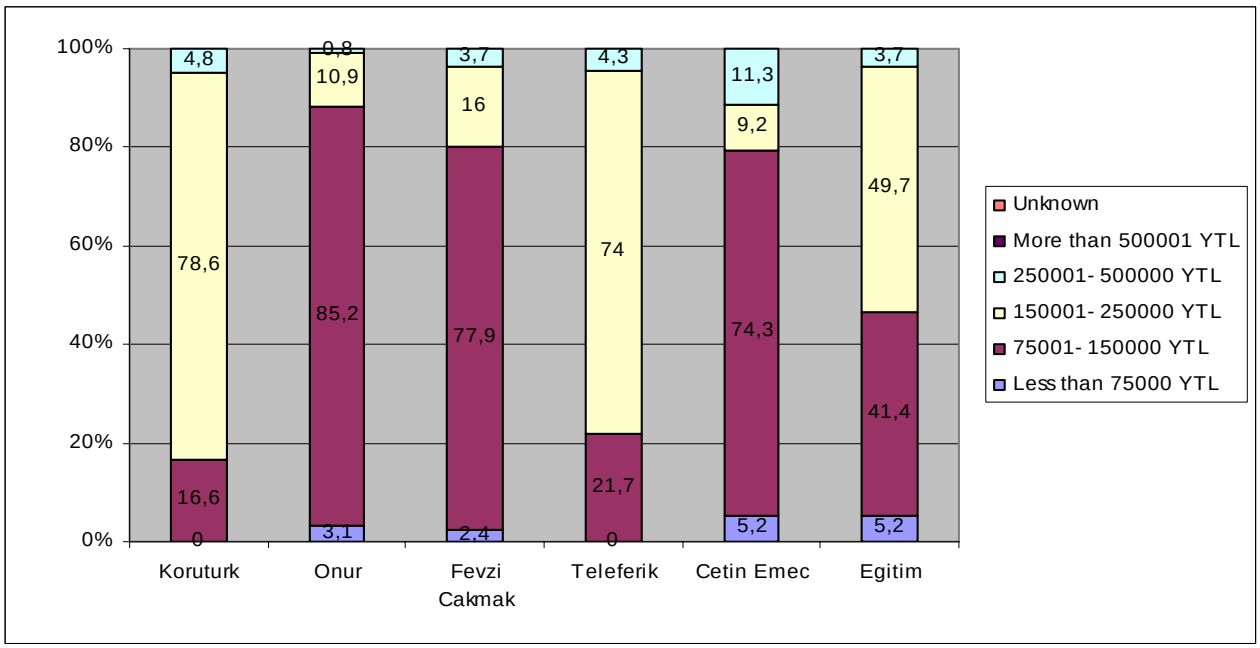


Figure 10: The percentage of building value for case areas in Balçova district.

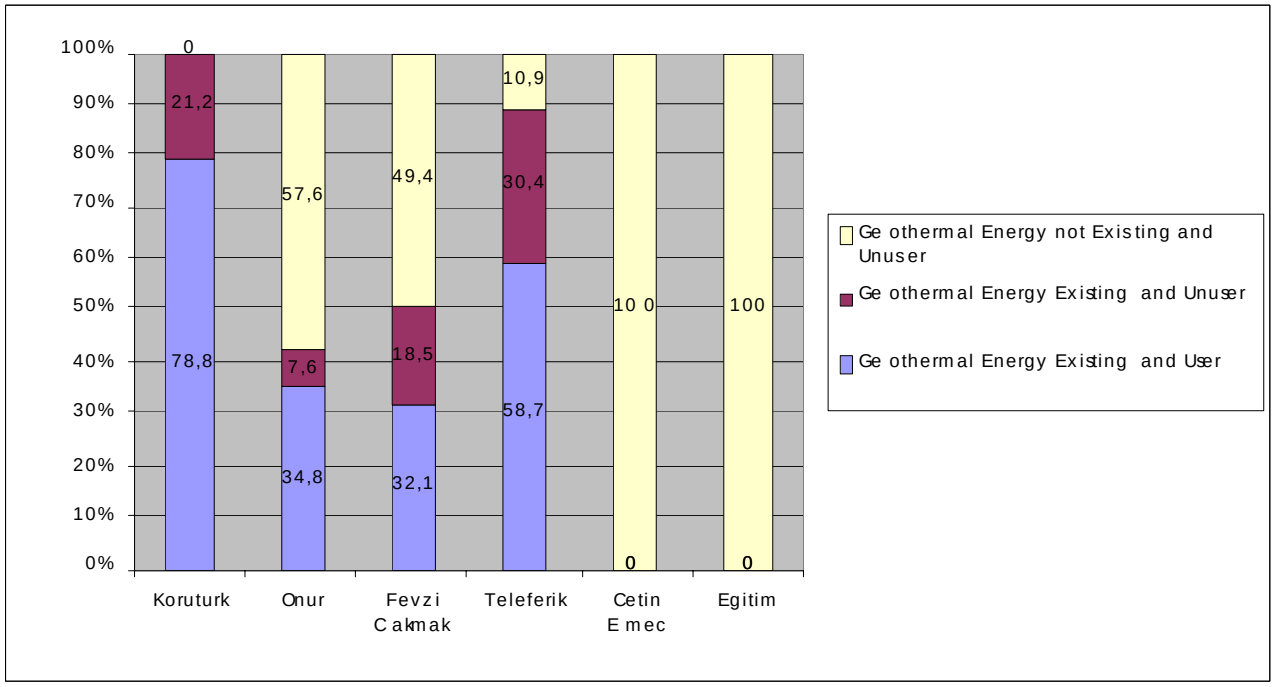


Figure 11: The percentage of geothermal using situation for case areas in Balçova district.

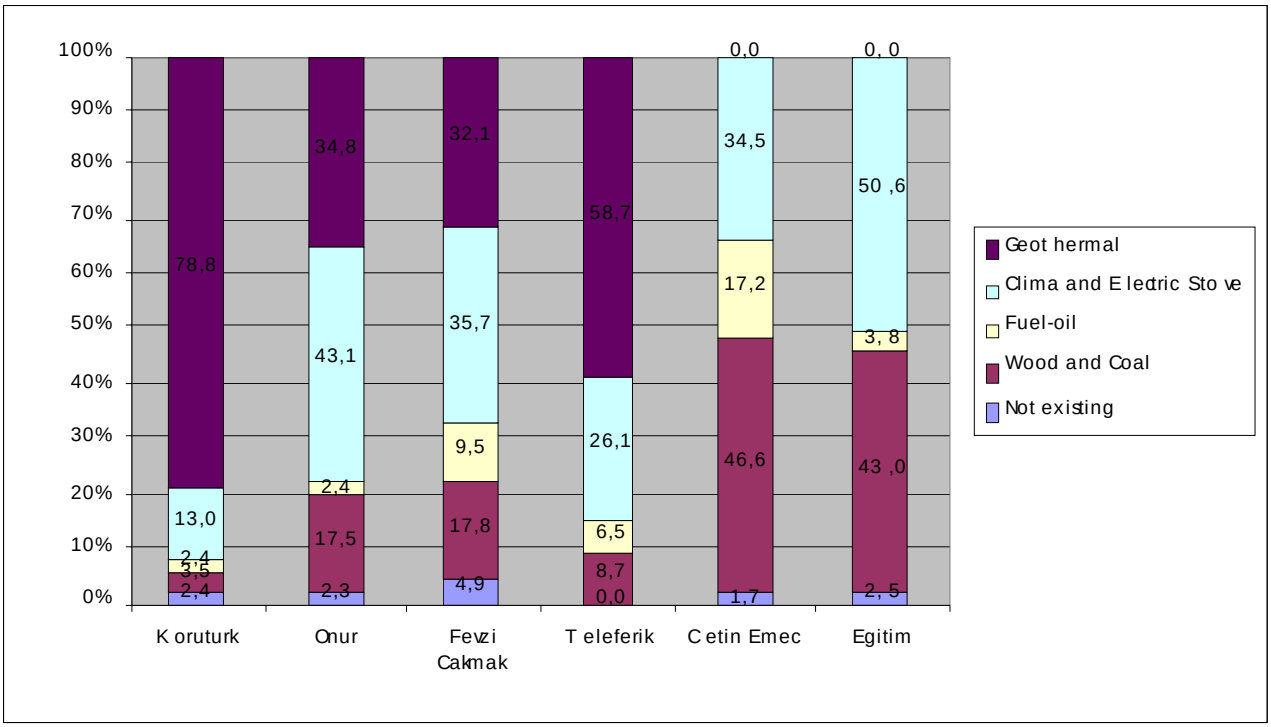


Figure 12: The percentage of energy using types for case areas in Balçova district.

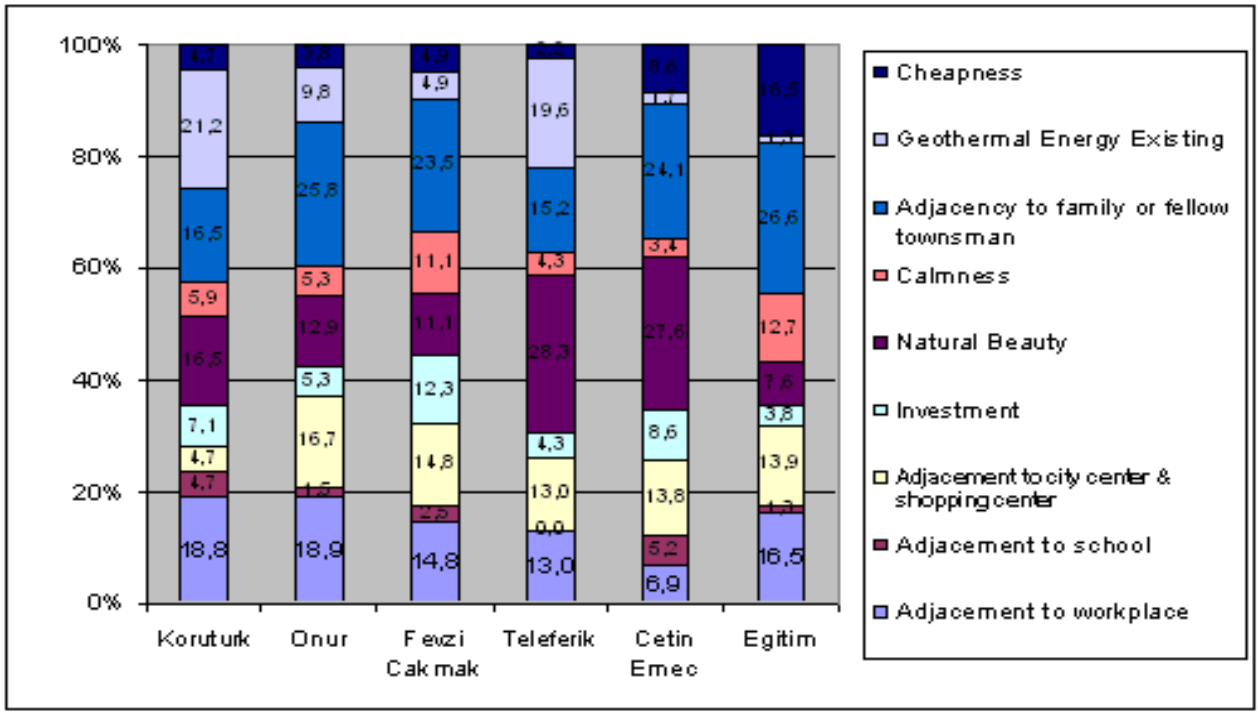


Figure 14: The percentage the reason of moving in Balçova district.

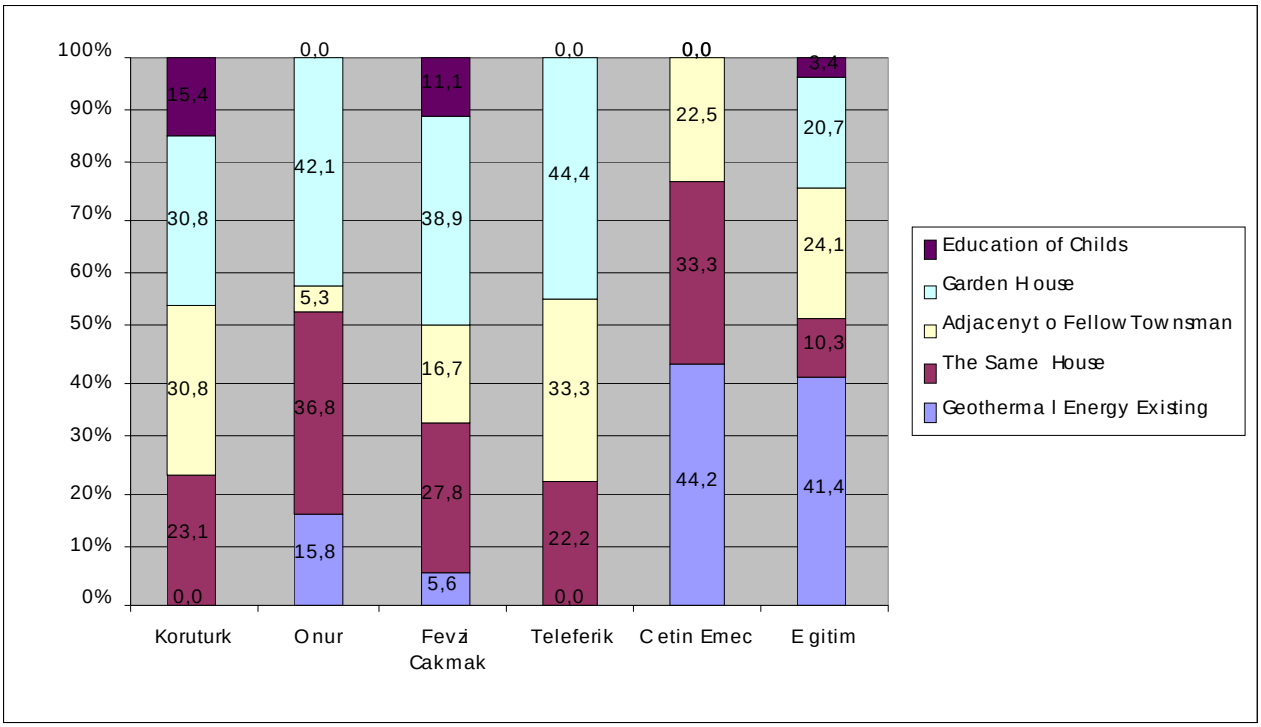


Figure 15: The percentage of willingness to moving out from Balçova district.

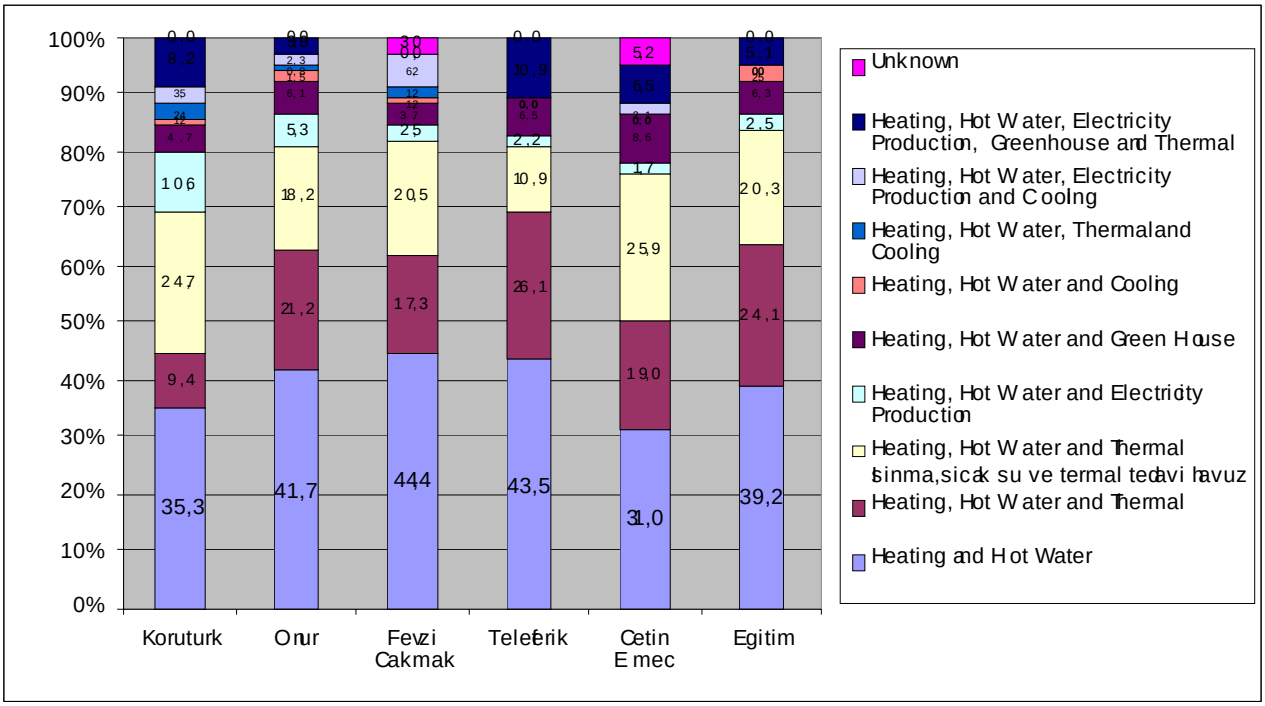


Figure 16: The percentage of knowledge about utilization of geothermal energy in Balçova district.

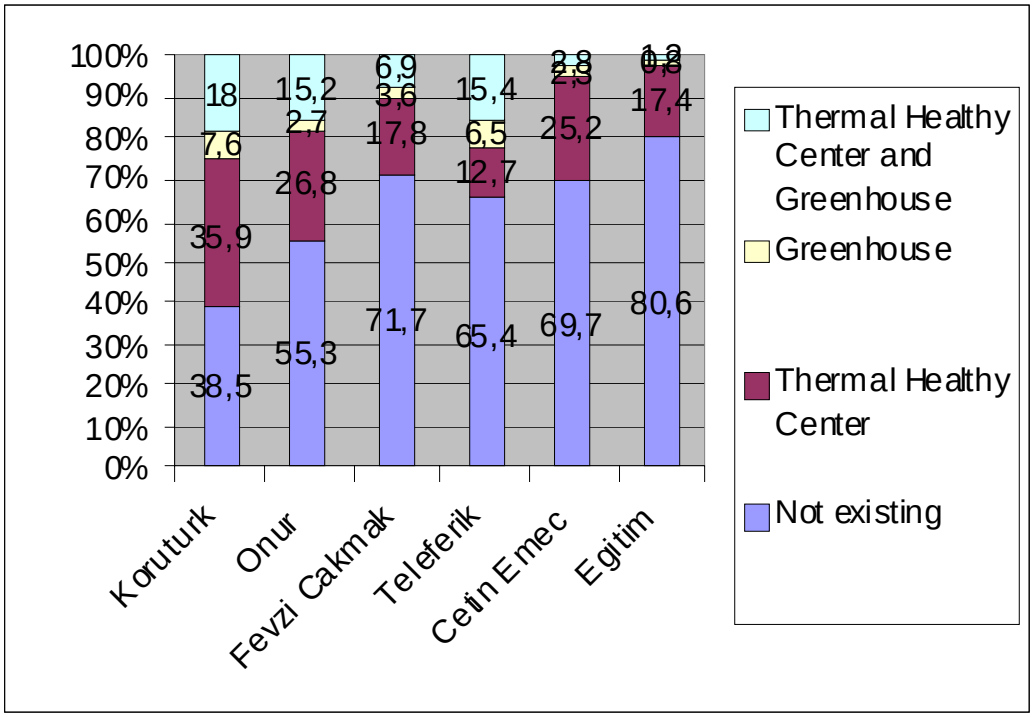


Figure 17: The percentage of utilization of geothermal energy facilities in Balçova district.

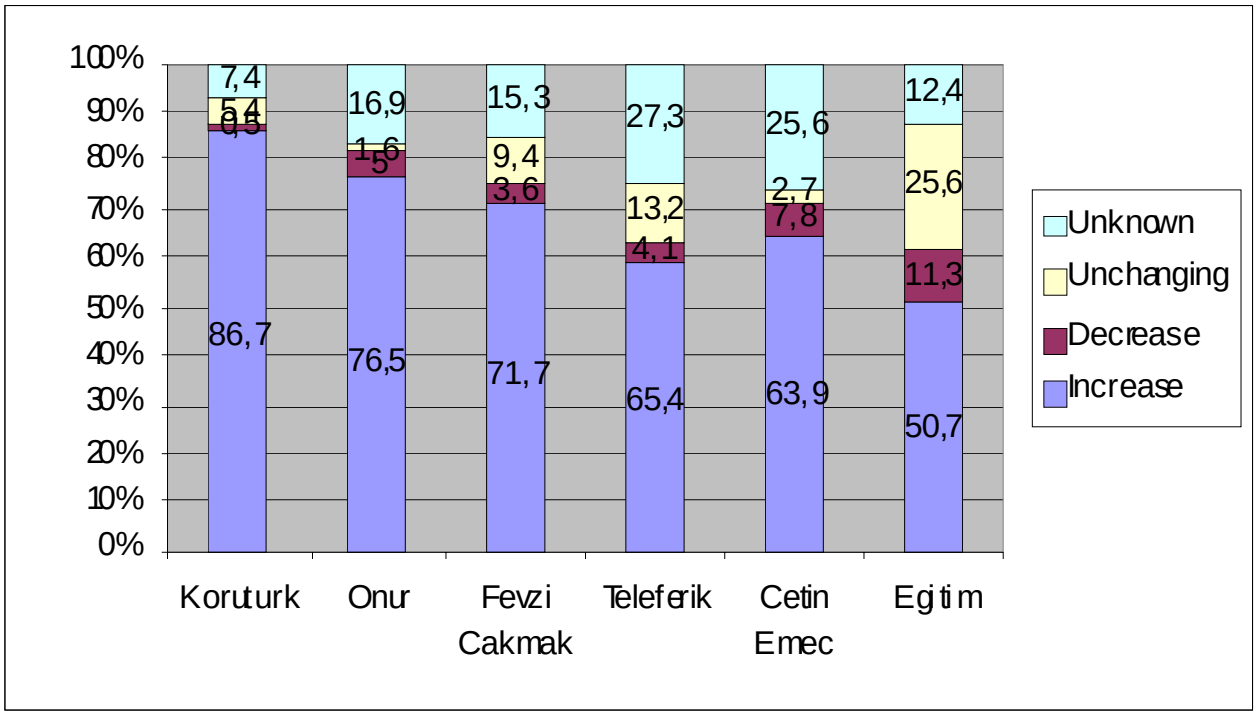


Figure 18. The percentage of the changing of population in Balçova district.

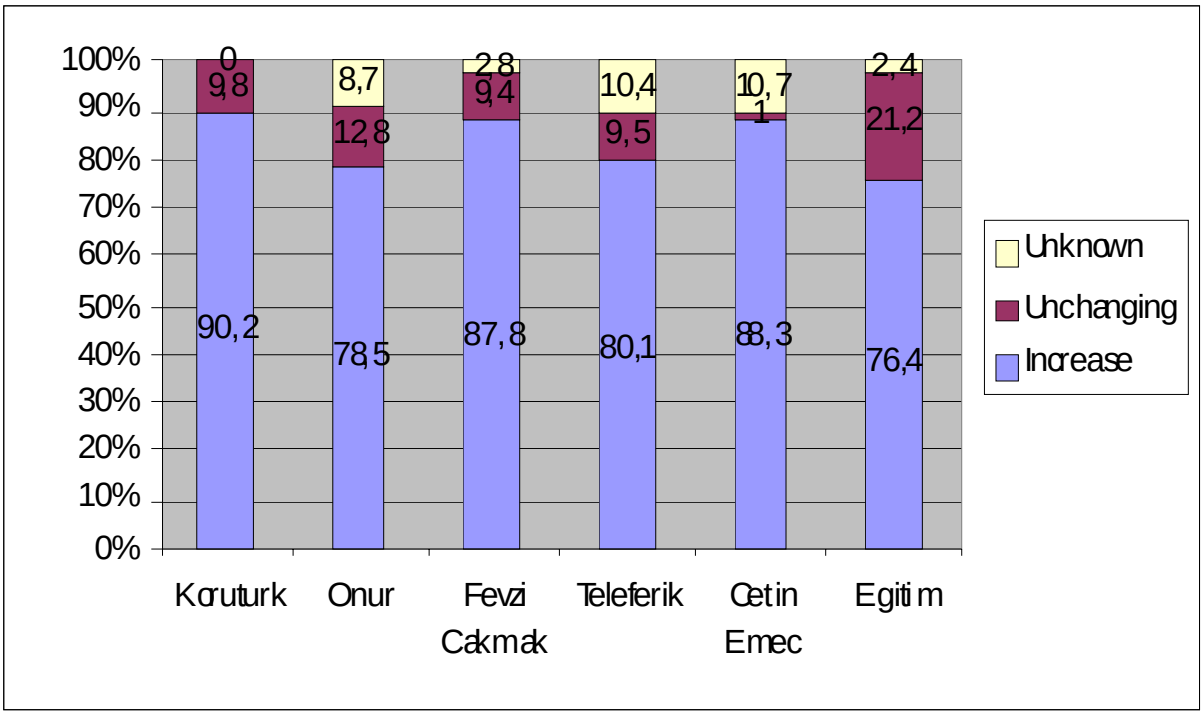


Figure 19: The percentage of the change in property values in Balçova district.

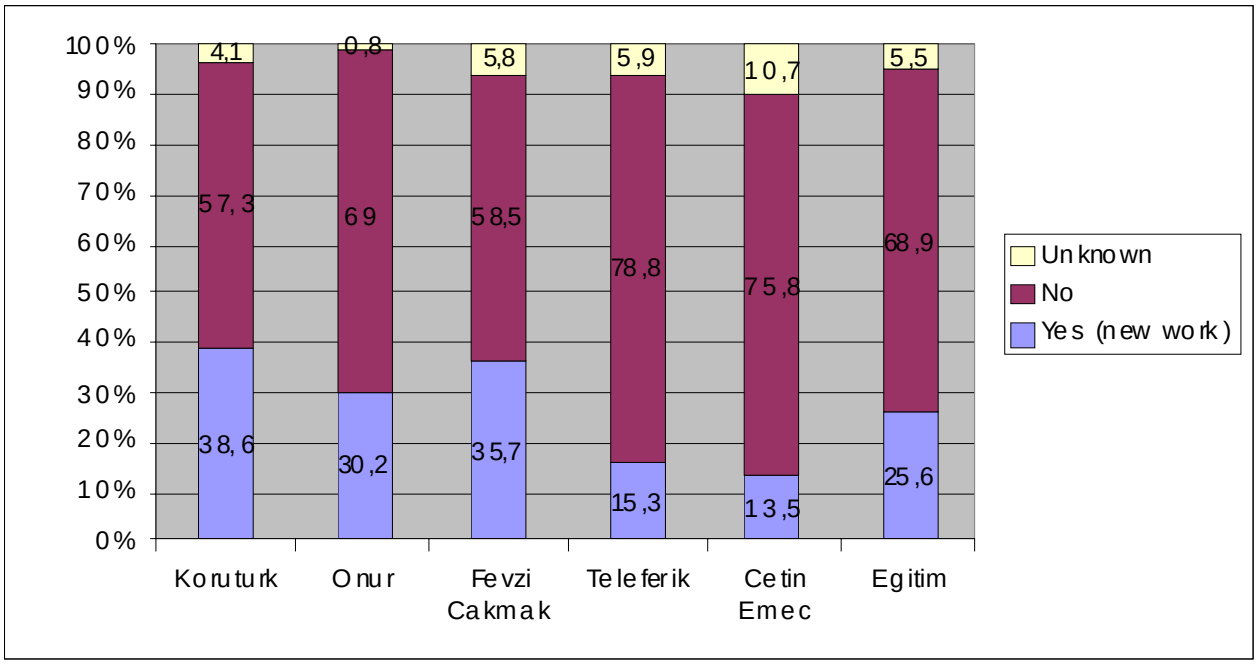


Figure 20: The percentage of the change of new work and employment situation in Balçova district.

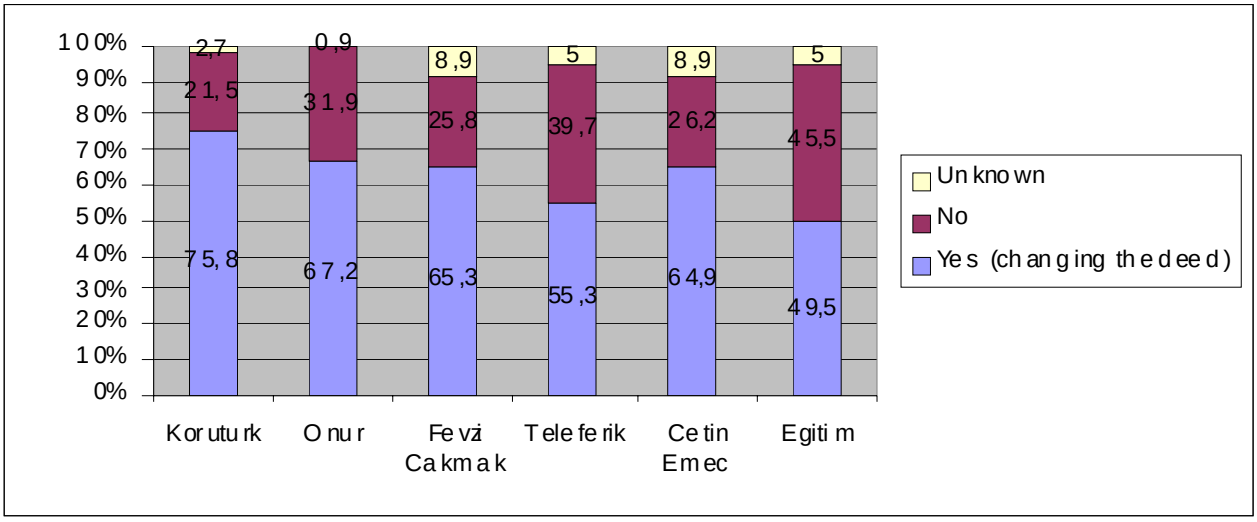


Figure 21: The percentage of the change of deed ownership in Balçova district.

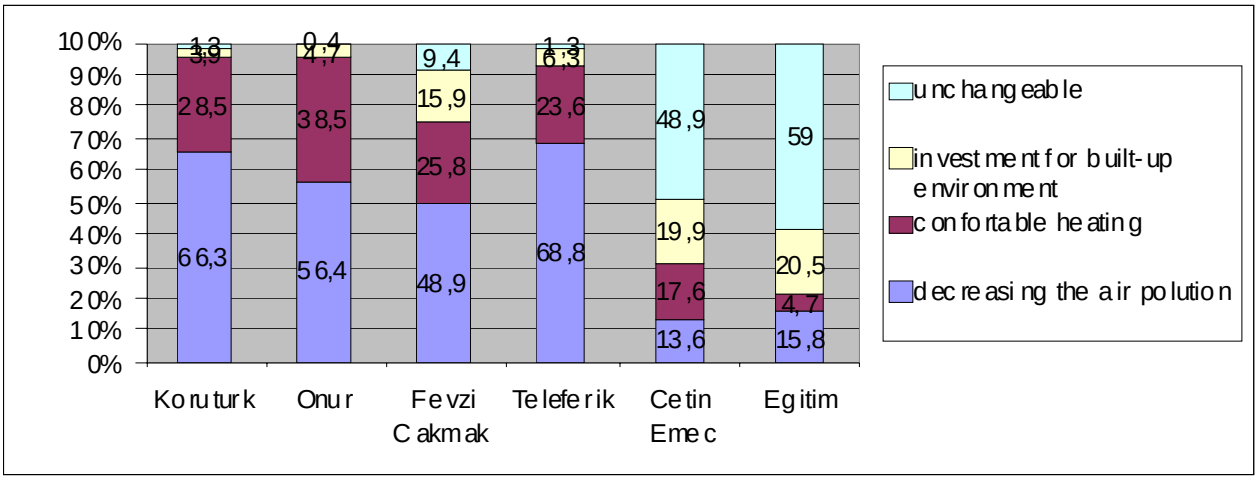


Figure 22: The percentage of the positive effects of geothermal energy in Balçova district.

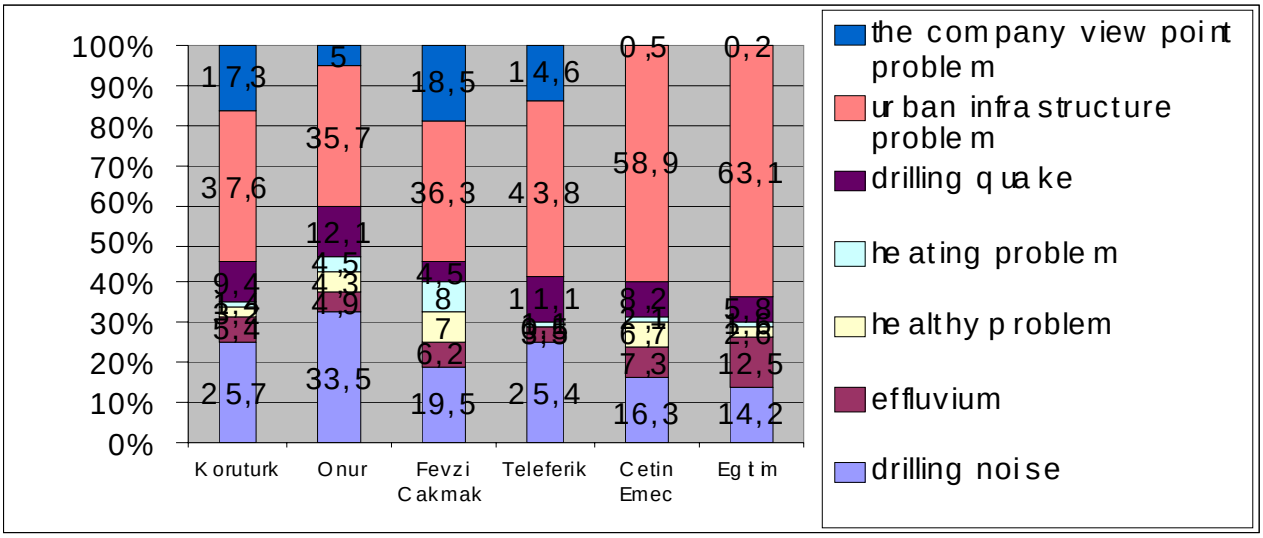
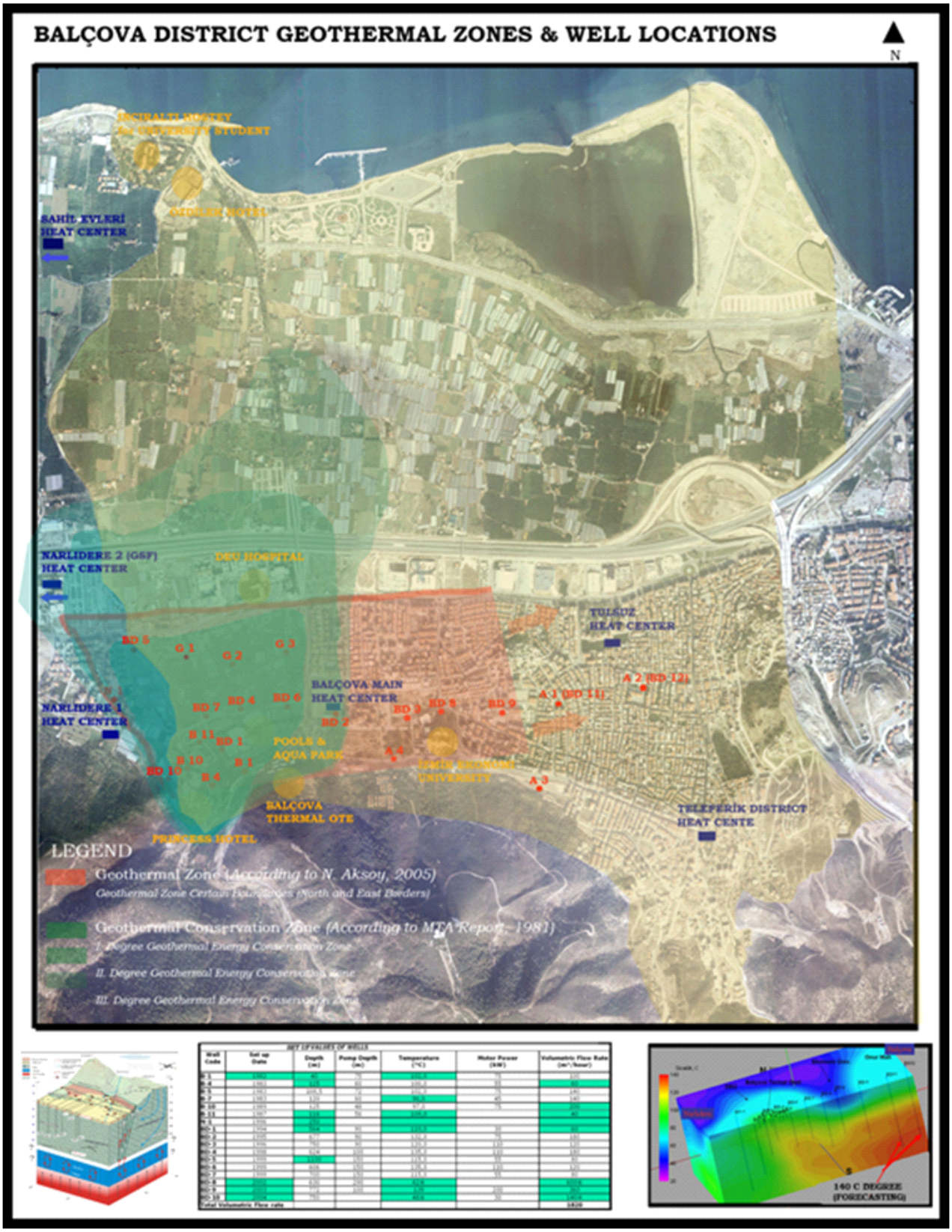


Figure 23: The percentage of the negative effects of geothermal energy in Balçova district.

APPENDIX A


BALÇOVA DISTRICT GEOTHERMAL HEATING APPLICATIONS
N
INCIRALTI UNI. STUDENT HOSTLY
CROWN PLAZA HOTEL
DEU HOSPITAL
BALÇOVA TUGSUZ SITES
NARLIDERE YENIKOY HOUSES
BALCOVA THERMAL HOSPITAL
POOLS & AQUA PARK
EKONOMI UNIVERSITY
PRINCESS HOTEL
BALCOVA THERMAL HOTEL
SYSTEM 2 (TELEFERIK DIST.)
LEGEND
Heating Region (1990-2000)
Heating Region (2000-2005)
Preparing Heating Region (2005-2006)

APPENDIX B


BALÇOVA DISTRICT GEOTHERMAL ZONES & WELL LOCATIONS
N
SAHİL EVLERİ HEAT CENTER
NARLIDERE 2 (GSF) HEAT CENTER
DEU HOSPITAL
NARLIDERE 1 HEAT CENTER
BALÇOVA MAIN HEAT CENTER
POOLS & AQUA PARK
BALÇOVA THERMAL OTE
PRINCESS HOTEL
TULSUZ HEAT CENTER
TELEFERİK DISTRICT HEAT CENTE
LEGEND
Geothermal Zone (According to N. Aksoy, 2005)
Geothermal Zone Certain Boundaries (North and East Borders)
Geothermal Conservation Zone (According to MTA Report, 1981)
I. Degree Geothermal Energy Conservation Zone
II. Degree Geothermal Energy Conservation Zone
III. Degree Geothermal Energy Conservation Zone
140 C DEGREE (FORECASTING)