



GÜRMAT ELEKTRİK ÜRETİM A.Ş. **GÜRMAT ELECTRIC GENERATION CO. INC.**



AYDIN PROVINCE, GERMENCİK DISTRICT, MESUDİYE
QUARTER

BLOCK 141, PLOTS 121, 133, 119, 97, 102; BLOCK 245, PLOT 147

EFE-7 GEOTHERMAL POWER PLANT **(25 MWe)**

EIA REPORT



FINAL EIA REPORT



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Project Name	EFE-7 GEOTHERMAL POWER PLANT (25 MWe)
Project Cost	TRY 62,500,000
Full address of the location selected for the project (Province, Block 141, Plots 121, 133, 119, 97, 102; Block 245, Plot 147)	Aydın Province, Germencik District, Mesudiye Quarter Block 141, Plots 121, 133, 119, 97, 102; Block 245, Plot 147
Location of the Project in the EIA regulation (Sector, Subsector)	List in Annex 1 of the EIA Regulation promulgated in the Official Gazette issue number 29186 dated 25.11.2014 List in ANNEX I 44 - Extraction and use of geothermal source (20 MWe or more thermal capacity)
PROJECT'S NACE CODE	35.11.19 Power generation
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Abbreviations

ABPRS	- Address Based Population Registration System
GIS	-Geographical Information System
EIA	-Environmental Impact Assessment
GPS	-Global Positioning System
TÜİK	-Turkish Statistical Institute
dB	-Decibel
kg	-Kilogram
km	-Kilometer
km ²	-Square kilometer
CHC	-Central Hunting Commission
m	-Meter
m ²	-Square meter
m ³	-Cubic meter
mm	-Millimeter
°C	-Celsius degree
OG	-Official Gazette
GPP	Geothermal Power Plant

NONTECHNICAL SYNOPSIS OF THE PROJECT

(Explanation of all the works planned and all the measures to be taken against environmental impacts during the construction and operation phases of the project in a way that does not contain technical terms and in understandable simplicity)

Efe-7 Geothermal Power Plant is planned to be erected and operated by Gürmat Elektrik Üretim A.Ş. for the purpose of electricity generation by utilizing the geothermal source within the licensed field.

The activity, which is the subject of the project, is planned to be carried out on the 32,283.345-m² area composed of Plots 121, 133, 119, 97, and 102 in Block 141 and Plot 147 in Block 245 at Seyrekkovalık Locality of Mesudiye Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm.

The plots intended to be used for Efe-7 Geothermal Power Plant are at the south of Efe-2 Geothermal Power Plant, which belongs to Gürmat Elektrik Üretim A.Ş. and is currently being operated, whereas the pool facility belonging to Efe-2 GPP is planned to be used jointly.

The project planned is going to be implemented within the field of the "Operating License no. J-553 for Operating Geothermal Sources and Natural Mineral Waters" registered to the firm owning the activity. The area licensed by the operating license no J-553 belonging to the activity owner is 3,530 hectares. Structures such as power generation and reinjection wells , wellhead facilities, transmission pipelines, etc. to be used within the scope of the project is within the field with operating license no J-553.

Our country ranks high among other countries in terms of its geothermal potential. The provinces Aydın and Denizli, located in Büyük Menderes graben comprising the largest geothermal energy potential in our country, have a large of this potential.

Geothermal energy is used in various areas in Aydın province where the project site is located, whereas a significant portion of electricity generation from geothermal energy is provided from this region.

The technology to be employed for the activity under the project is as follows: ground heat is brought to surface by means of fluids and drilling; the fluid is transported to the power plant to convert this energy into electrical energy; the fluid is separated here into water and steam to obtain electricity; and the hot water is re-pumped to underground after energy generation.

The 25-MWe installed power in this project will be operated as Binary type, and the electrical energy to be generated in the plant will be transmitted to the national system through a connection to 154-kV Germencik Substation by means of a switchyard. Approximately 200,000,000 kWh of annual generation is planned under the Efe-7 GPP project.

The geothermal fluid to be used will convey from production wells to the plant in a completely sealed system. After the separation of water and steam, electricity will be obtained from the steam and water remaining from energy generation will re-pumped to underground through reinjection wells.

The electrical energy to be generated within the scope of the project will be used to meet the increasing energy needs in our country. The electrical energy to be generated by the plant will partially meet the energy deficit of the country and will contribute to the development of the country by meeting the growing electricity demand.

250 and 8 personnel are planned to be employed during project's construction and operation phases, respectively.

The residential area closest to the project site is Germencik District which is located approximately 630 m northwest. The locations of other residential areas are as follows: Reisköy Quarter is 1.9 km southwest of the project site, Mesudiye Quarter is 4.8 km northeast, Akçeşme Quarter is 6 km northeast, Erbeyli Quarter is 5.6 km east, and Sınırteke Quarter is 5.4 km east. The distance of the activity area to Aydın city center is approximately 19 km.

Access to the project site can be provided via the İzmir-Aydın highway (D-550). The Site Location Map showing the project site is in Annex-1, whereas 1/25,000-scale Topographic Map is in Annex-2, 1/25,000-scale Land Assets Map is in Annex-3, 1/25,000-scale Geological Map is in Annex 4, and 1/100,000-scale Environmental Plan in Annex-5.

In accordance with Article 9 of the "Regulation on Environmental Impact Assessment" promulgated in the Official Gazette issue number 29186 dated 25.11.2014, a meeting for "public participation in the EIA process" has been held in Germencik District within the scope of EIA efforts related to the project in order to inform the public about the investment and to get their opinions and suggestions on the project before the meeting for determining the scope and custom format.

Following the agreement with Aydın Provincial Directorate of Environment and Urbanization on the venue and time of the Public Participation Meeting, the meeting has been held at a venue, where local people can come easily, in the residential area which will be impacted by the project most.

It is aimed to assess the expected environmental impacts of the intended "Geothermal Power Plant" during the construction and operation phases, identify and prevent or minimize its adverse impacts.

Prior to construction and operation phases, opinions and necessary permits shall be obtained from relevant institutions and organizations, and the plant shall not be commissioned before completing the permit processes in line with these opinions.

In order to minimize the environmental impacts of the project, The relevant laws, regulations and bylaws of the environmental legislation shall be observed at all stages of the said project.

"Environmental Law" No. 2872 as well as the regulations enacted pursuant to this law shall be observed within the scope of the project.

The measures to be taken against potential environmental impacts arising from the activities under the project are discussed in detail in this EIA Report.

CHAPTER I:

**DEFINITION, LOCATION AND
CHARACTERISTICS OF
THE PROJECT**

CHAPTER I: DEFINITION, LOCATION AND CHARACTERISTICS OF THE PROJECT**I.1. Definition, lifetime, service purposes, significance, and****necessity of the project Definition of the project investment**

Efe-7 Geothermal Power Plant with a total installed power of 25 MW is planned to be erected and operated by Gürmat Elektrik Üretim A.Ş. for the purpose of electricity generation by utilizing the geothermal source in Seyrekkovalık Locality of Mesudiye Quarter of Germencik District of Aydın Province.

It is aimed to generate approximately 200,000,000 kWh per year within the scope of Efe-7 GPP project.

The plant will use the geothermal source located in the investor firm's licensed field in Germencik district of Aydın province. This Operating License is given in Annex-9.

Table 1. J- 553 operating license details

License details	
License No	J-553
Province	Aydın
District	Germencik
Village	Ömerbeyli
Type of the source	Geothermal source
Effective date of the license	April 01, 2004
Expiration date of the license	April 01, 2034
Access number of the licensed field	3312184
Licensed field (hectares)	3,530
License owner	Gürmat Elektrik Üretim A.Ş.
Sheets to which the license belongs	M19a1, M19a2, M19a3, M19a4,

All the activities under the project shall be carried out within the boundaries of the field of the "Operating License no. J-553 for Operating Geothermal Sources and Natural Mineral Waters". A satellite image showing the licensed field is given in Figure 1.



Figure 1. Licensed field no J-553

The power generation technology to be employed for the project is as follows: geothermal source is brought to surface; the fluid is transported to the power plant to convert this energy into electrical energy; the fluid is separated here into water and steam to obtain electricity; and the hot water is re-pumped to underground after energy generation.

The activity, which is the subject of the project, is planned to be carried out on the 32,283.345-m² area composed of Plots 121, 133, 119, 97, and 102 in Block 141 and Plot 147 in Block 245 at Seyrekkovalık Locality of Mesudiye Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm. (See Annex-10)

It is planned to provide the connection of electrical energy to be generated within the scope of Efe-7 Geothermal Power Plant Project to the national interconnected system via "154 kV Germencik substation".

The construction work within the scope of the Efe-7 Geothermal Power Plant project is expected to last 12 months in average. It is estimated that the economic life of the project will be 30 years by means of the license modification procedures to be completed within the scope of the project.

This report has been authored by assessing this project based on 'Article 44 - Extraction and use of geothermal resources (20 MWe or more thermal capacity)' of the "Regulation on Environmental Impact Assessment" promulgated the Official Gazette issue number 29186 dated 25.11.2014.

Lifetime of the investment and its service purposes, significance and necessity

Due to advancing technology all over the world, people's needs for electrical energy also increase. Due to the fact the current fossil resources used in electricity generation are limited and they deplete day by day, electrical energy saving efforts is being continued on the one hand, while efforts to generate electrical energy by using other sources are continuing at a great pace.

The energy needs of our country are constantly increasing due to development. Therefore, meeting this need is a must. Geothermal energy generation is very important in terms of making use of our renewable energy resources, which are clean and natural with minimum adverse impacts on the environment, at the highest level to meet this inevitable need.

Our nation strives to realize its development goals, to increase social welfare and to bring the industrial sector to a level that can compete internationally. This has led to a rapid increase in energy demand for many years.

Electricity consumption between years 1923 and 2016 in our country is shown in the following graphs. Consumption values on the graph are given as terawatt-hours.

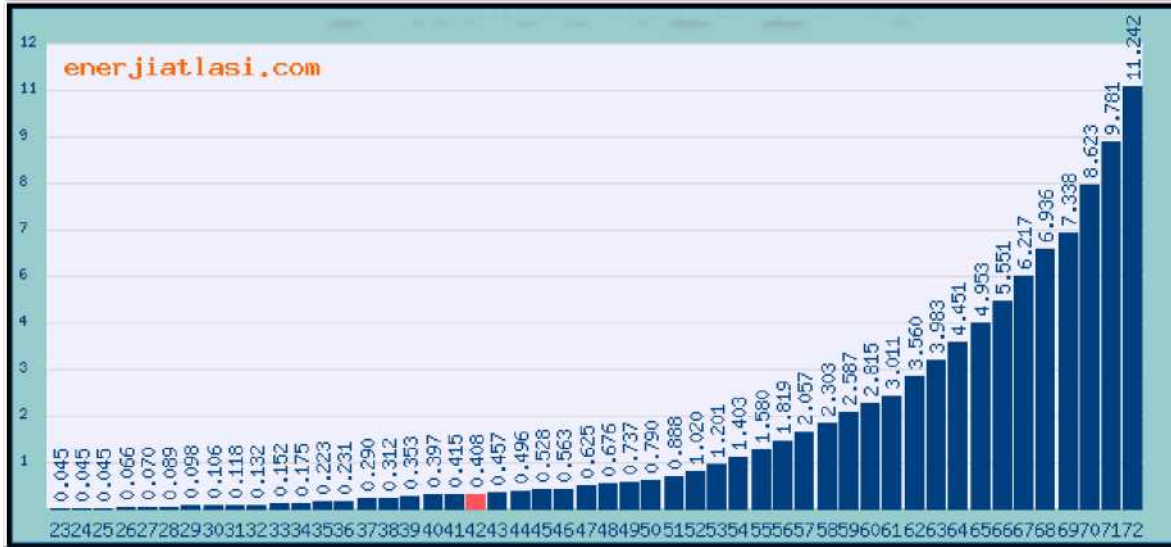


Figure 2. Electricity consumption 1923-1972

Source: www.enerjiatlasi.com, January, 2017.

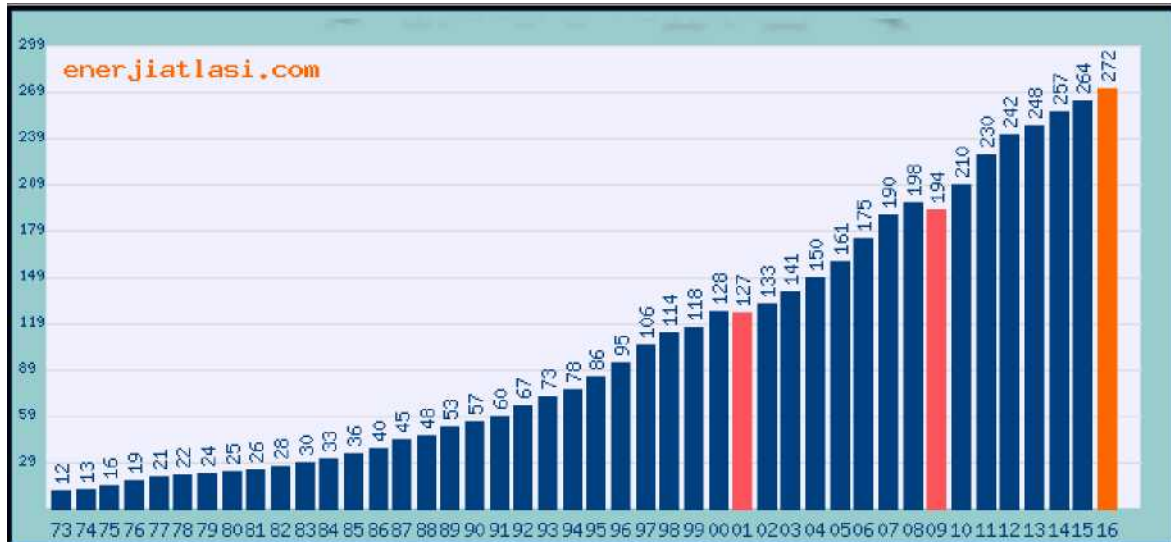


Figure 3. Electricity consumption 1973-2016

Source: www.enerjiatlasi.com, January, 2017.

As the efforts conducted for the use of renewable resources in the generation of electrical energy reduce the external dependence, its importance for the future of nations is obvious. One of the efforts carried out within this scope is the generation of electrical energy by using geothermal potentials which have developed in the world in recent years.

Distribution and application map of geothermal sources in our country is given in Figure 4.



It appears that energy needs increase in our country every day. The exhaustibility of traditional energy resources and the depletion of reserves in the coming years have lead humanity to new energy resources. Therefore, geothermal energy generation is very important in terms of making use of our renewable energy resources, which are clean and natural with minimum adverse impacts on the environment, at the highest level to meet this energy need.

The sources used for electrical energy generation in our country are illustrated in Figure 5.

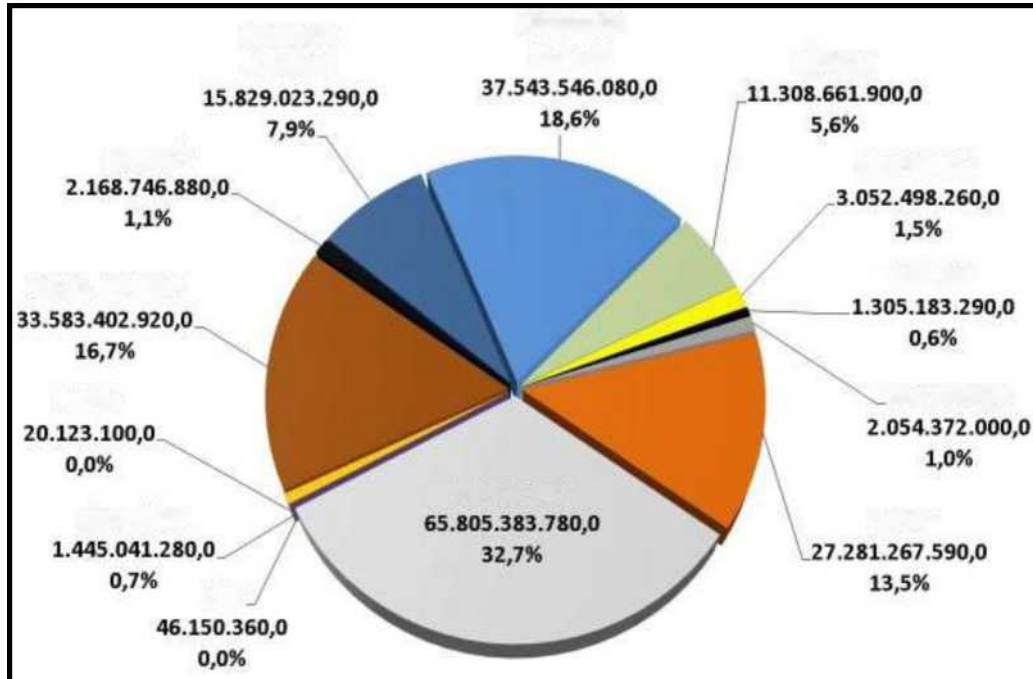


Figure 5. Electricity generation in Turkey (as of October 2016)

Source: TEİAŞ, <http://www.teias.gov.tr>, January, 2017

The word geothermal comes from the words geo (earth) and therme (heat) in Greek and refers to ground heat or the heat of the earth. The internal heat of the earth originating from dust and gases gathered at high temperatures about 4 billion years ago is continuously renewed as a result of decay of the radioactive elements in all the earth's rocks.

A geothermal source refers to a spot where the temperature is constantly above the annual average of the regional atmospheric temperature with the effect of the earth's crust depending on the geological structure, that may contain more molten substance and gas than surrounding water sources, water, steam and gasses are emerged naturally or extracted, or water, steam and gases are obtained by heating them by the earth's crust or hot dry rocks to which they are sent human arrangements. Geothermal energy is the energy obtained by the heat of the hot rocks and fluids in the depths of the earth's crust passing through the weak layers and reaching the earth.

Since the waters forming the geothermal fluid are meteoric origin, the reservoirs are fed continuously and the resource can be renewed if the reservoir is well managed. Therefore, in practice, there is no depletion of geothermal resources unless it is used more than feeding. The geothermal reservoirs formed by feeding the porous and cracked rock masses of the rain, snow, sea and magmatic waters in the underground maintain their renewable and sustainable characteristics if the geological conditions continue, the reinjection process is carried out, and the feeding generation values are observed. In other words, the rain water or other water sources that go underground are warmed up again as they pass near the hot rock and magma layer in suitable places and they get back to the surface. This cycle makes geothermal energy renewable.

The usage areas of geothermal resources were limited to healthcare and cooking until the beginning of the 20th century (geothermal energy was used by ancient Romans for healthcare purposes and as a natural hot water source to thermal baths), but it has become very widespread and diversified due to technological developments. These include electricity generation, heating and various uses in the industry. The use of energy from natural underground heat sources is rapidly increasing. Electricity is generated from geothermal energy under conditions where temperature is appropriate.¹

The geothermal resource utilization capacities for the purpose of obtaining electricity in the world are given in Table 2.

¹ T.C. Millî Eğitim Bakanlığı, Yenilenebilir Enerji Teknolojileri - Yenilenebilir Enerji Kaynakları Ve Önemi, Ankara, 2012

Table 2. Use of geothermal resources in the world

Country	Capacity (MW)	Capacity (MW)	Capacity (MW)	Capacity (MW)
	2007	2010	2013	2016
USA	2,687.00	3,086.00	3,389.00	3,450.00
Philippin	1969.7	1,904.00	1,894.00	1,870.00
Indonesia	992.00	1,197.00	1,333.00	1,340.00
Mexico	953.00	958.00	980.00	1,017.00
New Zealand	471.6	628.00	895.00	1,005.00
Italy	810.5	843.00	901.00	916.00
Turkey	38.00	82.00	163.00	754.00
Iceland	421.2	575.00	664.00	665.00
Kenya	128.8	167.00	215.00	594.00
Japan	535.2	536.00	537.00	519.00
Costa Rica	162.5	166.00	208.00	207.00
El Salvador	204.4	204.00	204.00	204.00
Nicaragua	87.4	88.00	104.00	159.00
Russia	79.00	82.00	97.00	82.00
Guatemala	53.00	52.00	42.00	52.00
Papua New Guinea	56.00	56.00	56.00	50.00
Portugal	23.00	29.00	28.00	29.00
Germany	8.40	6.60	13.00	27.00
China	27.80	24.00	27.00	27.00
France	14.70	16.00	15.00	16.00
Ethiopia	7.30	7.30	8.00	7.30
Austria	1.10	7.30	1.00	1.20
Australia	0.2	1.10	1.00	1.10
Thailand	0.3	0.3	0.3	0.3
Total	9,731.9	10,709.7	11.765	12,992.90

The construction work within the scope of the Efe-7 Geothermal Power Plant project is expected to last 12 months. It is estimated that the economic life of the project will be approximately 30 years by means of the license modification procedures to be completed within the scope of the project.

Since the energy to be generated by Efe-7 Geothermal Power Plant project would contribute to national energy generation, it is expected to help development of industry, revival and development of economic life in the region, and our country's resource diversity, reduce the use of natural gas, and contribute in terms of supply security.

The electrical energy to be generated within the scope of the project will be fed to the energy transmission line and will be put into use by the transmission and distribution networks and will play an important role in meeting the increasing electricity needs of our country. Continuous, reliable and high-quality electricity to be supplied will attract foreign investments and contribute to the country's industrial development. In addition, the establishment and operation of the geothermal power plant will provide an economic contribution to the local people, who will have short and long term employment opportunities, and the plant will play a role in increasing the per capita income by enabling new jobs in the private sector.

I.2. Location selected for the project (environmental plan showing the project location, plan notes & provisions and legends thereof, notes and legends of master development plan and land use plan (approved by the relevant agency), scaled map if these plans are unavailable)

Efe-7 Geothermal Power Plant with a total installed power of 25 MW is planned to be erected and operated by Gürmat Elektrik Üretim A.Ş. for the purpose of electricity generation by utilizing the geothermal source in Seyrekkovalık Locality of Mesudiye Quarter of Germencik District of Aydın Province.

The maps, plans and images where the project site is illustrated are as follows:

- 1/25,000-scale topographic map in Annex-2,
- 1/25,000 scale land assets map in Annex-3,
- 1/25,000-scale geological map in Annex-4,
- 1/100,000 scale environmental plan in Annex-5, and
- Photos and satellite images of the project site in Annex-7.

According to the 1/100,000-scale Environmental Plan and Plan Notes of Aydın-Muğla-Denizli Planning Zone, the project site is on the M19 sheet.

The activity, which is the subject of the project, is planned to be carried out on the 32,283.345-m² area composed of Plots 121, 133, 119, 97, and 102 in Block 141 and Plot 147 in Block 245 at Seyrekkovalık Locality of Mesudiye Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm. The title deeds of the aforementioned plots are presented in Annex-10.

Efe-2 Geothermal Power Plant which is currently being operated and belonging to the same company exists on plot 147 of Block 245, which is one of the plots where the activity of the project is to be carried out; and the southwest part of this plot, which is currently idle, is intended to be used for the Efe-7 Geothermal Power Plant project. The "EIA Positive" certificate issued for the Efe-2 Geothermal Power Plant project is given in Annex-12.

There are existing roads around the project site. The site is accessed through the İzmir-Aydın highway, which provided transportation to Germencik district as well. The project site is accessed through a crossroad passing along the boundary of the site and connecting to the highway. Satellite image showing the existing roads and the plots of the project are given below.

The residential area closest to the project site is Germencik District which is located approximately 630 m northwest. The locations of other residential areas are as follows: Reisköy Quarter is 1.9 km southwest of the project site, Mesudiye Quarter is 4.8 km northeast, Akçeşme Quarter is 6 km northeast, Erbeyli Quarter is 5.6 km east, and Sınırteke Quarter is 5.4 east. The distance of the activity area to Aydın city center is approximately 19 km.



Figure 6. Satellite image showing the plots of the project and the existing roads

Access to the project site can be provided via the İzmir-Aydın highway (D-550).

According to the provisions of 1/100,000-scale Environmental Plan of the Aydın-Muğla-Denizli planning zone:

In the article entitled General Provisions, it is stipulated as follow: "7.35. Energy resource areas shall be protected within the framework of the Law no. 5346 on the use of renewable energy sources electrical energy generation purposes".

In the article entitled Energy Generation Areas and Energy Transmission Facilities, it is stipulated as follows: "8.21.1. Master development plan and land use plan concerning renewable energy (wind, solar, geothermal, hydroelectric) generation areas prepared under the permits to be issued by relevant institutions and organizations and the license to be issued by the Energy Market Regulatory Authority, based on the ministry's opinion, without the need to change this environmental plan, in accordance with the opinions of relevant institutions and organizations, shall be approved by the relevant administration and submitted to the ministry digitally to be recorded to the database of this plan".

The project site is within "agricultural lands" and "irrigation areas" according to the 1/100,000-scale Environmental Plan of Aydın-Muğla-Denizli region. All aspects of the provisions of the 1/100,000-scale Environmental Plan shall be complied with in all stages of the project.

The development plan process related to the project site shall be carried out in parallel with the EIA process, and it shall be ensured that the plans concerning the geothermal power plant are approved in line with the Development Plan Law no. 3194 and the relevant regulations.

The project site is within agricultural lands areas according to the 1/100,000-scale Environmental Plan of Aydın-Muğla-Denizli region, so the necessary protection measures shall be taken within the scope of the Efe-7 Geothermal Power Plant Project; and prior to the beginning of the construction of the project, a "Permit for Non-agricultural Use" shall be obtained from Aydın Provincial Directorate of Food, Agriculture and Livestock pursuant to the Soil Conservation and Land Use Law no. 5403 and the Regulation for Implementation of the Soil Conservation and Land Use Law promulgated in Official Gazette issue number 26024 dated 15.12.2005.

Since the Soil Conservation and Land Use Law no. 5403 shall be complied with for the agricultural lands within the scope of the project, in accordance with Article 21 (a) of the Law, no non-agricultural activities shall be carried out in the project site during the process of obtaining legal permits.

All the activities under the project shall be carried out within the boundaries of the field of the "Operating License no. J-553 for Operating Geothermal Sources and Natural Mineral Waters". The coordinates of the said licensed field is given in Table 3.

Table 3. Coordinates of the licensed field

CORNER COORDINATES	Coordinate order : Right, Up Datum : ED-50 Type : UTM Segment central meridian 27 Zone 35 Scale factor: : 6 degree		Coordinate order : Latitude, Longitude Datum : WGS-84 Type : GEOGRAPHICAL Segment central meridian 27 Zone 35 Scale factor: : -----	
	Y	X	Latitude	Longitude
1	552800	4195250	37.90157654	27.60010501
2	560000	4194000	37.88986511	27.68189288
3	561000	4193000	37.88078633	27.69318038
4	560000	4190000	37.85381551	27.68156070
5	552800	4190000	37.85426074	27.59972127

The coordinates of the field of activity of the project are given in Table 4.

Table 4. Coordinates of the project site

CORNER COORDINATES		Coordinate order : Right, Up Datum : ED-50 Type : UTM Segment central meridian 27 Zone 35		Coordinate order : Latitude, Longitude Datum : WGS-84 Type : GEOGRAPHICAL Segment central meridian 27 Zone 35 Scale factor: : -----	
		Y	X	Latitude	Longitude
P o l y g o n A	1	553876.757	4190607.769	37.859675320	27.612005720
	2	554023.109	4190610.746	37.859693490	27.613669600
	3	554040.091	4190612.520	37.859708470	27.613862770
	4	554039.688	4190512.579	37.858807770	27.613850720
	5	553988.342	4190518.103	37.858860600	27.613267470
	6	553956.775	4190522.721	37.858904090	27.612908980
	7	553933.604	4190527.440	37.858947990	27.612645930
	8	553926.037	4190530.069	37.858972130	27.612560110
	9	553912.472	4190536.696	37.859032660	27.612406410
	10	553897.968	4190547.242	37.859128560	27.612242320
	11	553891.461	4190553.190	37.859182550	27.612168800
	12	553885.803	4190560.347	37.859247390	27.612105010
	13	553881.805	4190568.244	37.859318800	27.612060160
	14	553879.396	4190576.941	37.859397320	27.612033420
	15	553877.397	4190591.945	37.859532670	27.612011810
P o l y g o n B	1	553801.541	4190595.121	37.859565770	27.611149760
	2	553854.939	4190561.375	37.859258480	27.611754250
	3	553932.928	4190512.544	37.858813780	27.612637140
	4	553967.974	4190509.276	37.858782250	27.613035280
	5	553995.201	4190506.321	37.858754010	27.613344560
	6	553998.182	4190505.997	37.858750910	27.613378420
	7	554006.539	4190505.917	37.858749700	27.613473410
	8	554012.889	4190467.260	37.858400920	27.613542700
	9	554001.753	4190463.176	37.858364780	27.613415810
	10	553998.937	4190462.143	37.858355630	27.613383720
	11	553968.301	4190450.906	37.858256170	27.613034640
	12	553898.888	4190425.447	37.858030830	27.612243700
	13	553866.084	4190413.415	37.857924330	27.611869910
	14	553832.137	4190400.964	37.857814110	27.611483100
	15	553828.980	4190449.180	37.858248850	27.611450800
	16	553823.122	4190461.825	37.858363160	27.611385160
	17	553818.734	4190499.689	37.858704670	27.611338090
	18	553818.454	4190516.393	37.858855230	27.611336160
	19	553813.846	4190556.347	37.859215590	27.611286750

The EIA area intended to be used within the scope of the project consists of two polygons, and the general status of the said areas is given in the following figure.

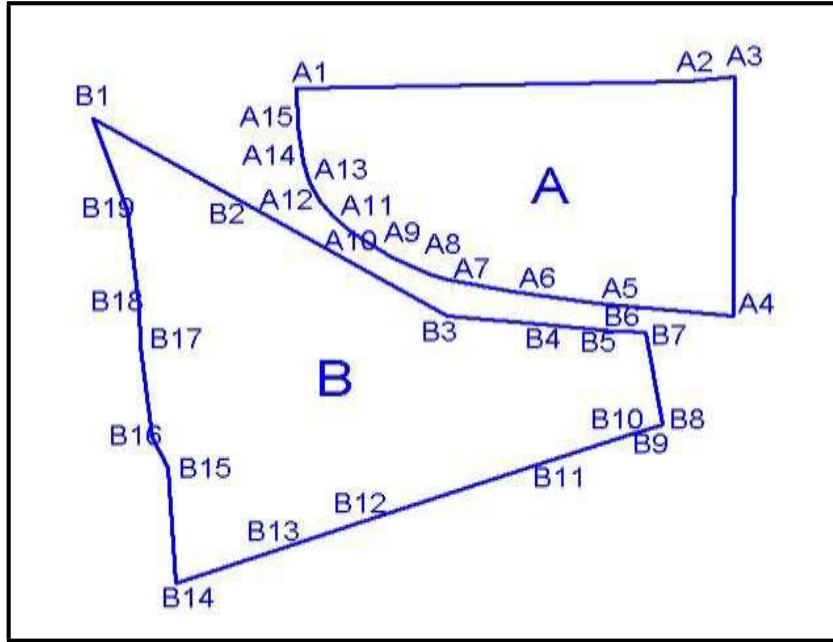


Figure 7. General layout of the project site

The surface area of the field under which the project activities will be carried out is 32,283.345 m² in total.

Table 5. Surface area information

NO	POLYGON	Surface area
1	POLYGON A	13,255.685 m ²
2	POLYGON B	19,027.660 m ²
		Total Area: 32,283.345 m ²

The activity, which is the subject of the project, is planned to be carried out on Plots 121, 133, 119, 97, and 102 in Block 141 and Plot 147 in Block 245 at Mesudiye Quarter of Germencik District of Aydın Province.

Efe-2 Geothermal Power Plant which is currently being operated and belonging to the same company exists on plot 147 of Block 245, which is one of the plots where the project is to be carried out; and the southwest part of this plot, which is currently idle, is intended to be used for the Efe-7 Geothermal Power Plant project. The "EIA Positive" certificate issued for the Efe-2 Geothermal Power Plant project is given in Annex-12.

The satellite image showing the said plots are given in Figure 8.

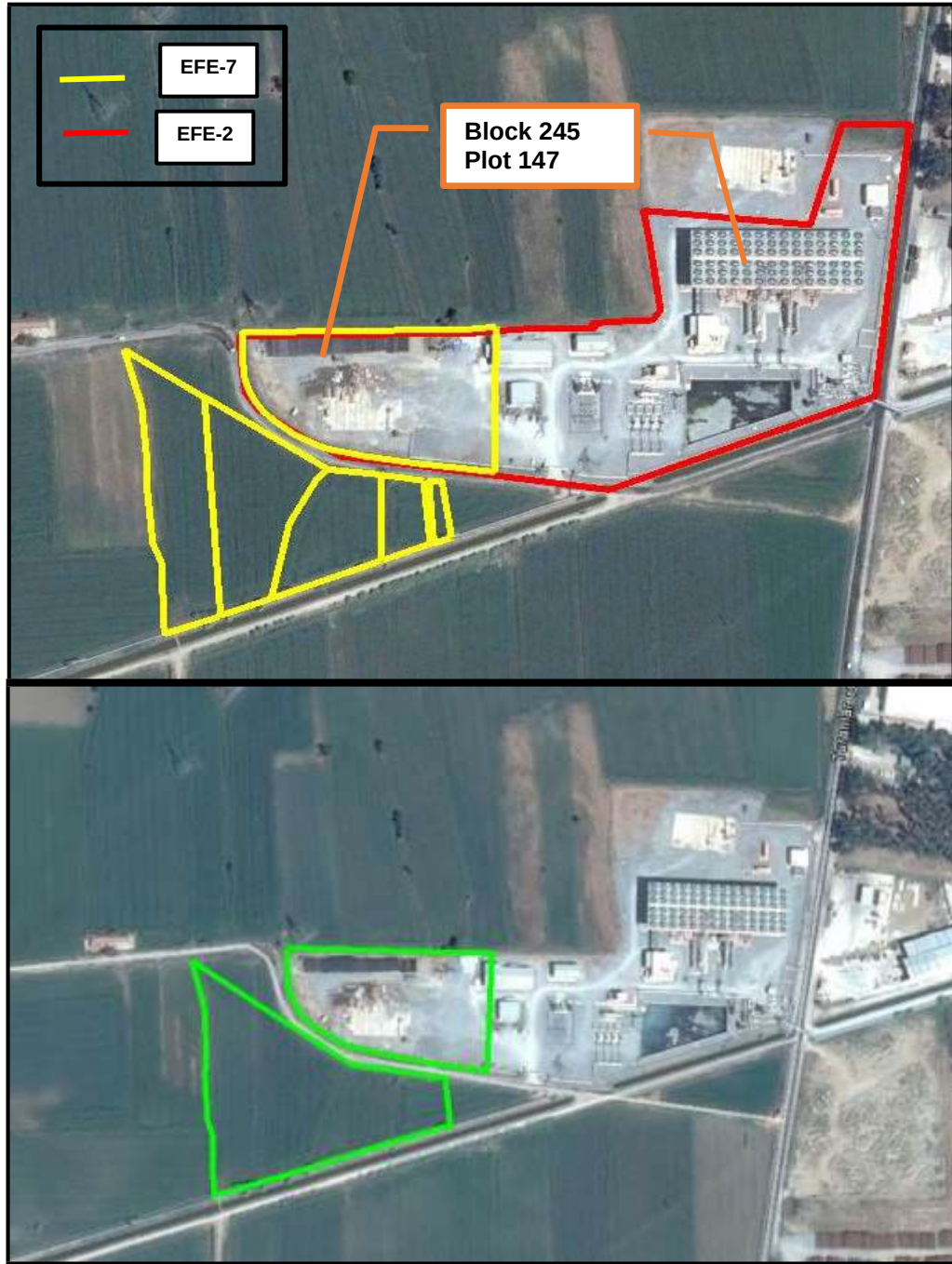


Figure 8. Satellite image of Efe-7 project site

The coordinates of power generation and reinjection wells intended to be used within the scope of the project are given in the following table.

Table 6. Coordinates of power generation and reinjection wells

EFE-7			Coordinate order : Right, Up Datum : ED-50 Type : UTM Segment central meridian 27 Zone 35 Scale factor: : 6 degree		Coordinate order : Latitude, Longitude Datum : WGS-84 Type : GEOGRAPHICAL Segment central meridian 27 Zone 35 Scale factor: : -----	
	Orde	Well name	Y	X	Latitude	Longitude
Power production wells	1	OB-50	554200.00	4191129.00	37.864353780	27.615719260
	2	OB-50A	554206.00	4191135.00	37.864407490	27.615787920
	3	OB-50B	554214.00	4191136.00	37.864416030	27.615878940
	4	OB-50C	554222.00	4191137.00	37.864424570	27.615969970
	5	OB-103A	554497.00	4192490.00	37.876602100	27.619198270
	6	OB-103B	554497.00	4192482.00	37.876530000	27.619197670
	7	OB-94A	555665.00	4191643.00	37.868897930	27.632413270
	8	OB-94B	555666.00	4191635.00	37.868825770	27.632424020
	9	OB-94C	555668.00	4191627.00	37.868753550	27.632446140
	10	OB-94D	555669.00	4191619.00	37.868681390	27.632456900
Reinjection wells	1	OB-57	554318.00	4190328.00	37.857127720	27.617000530
	2	OB-61	555030.00	4190960.00	37.862780940	27.625142020
	3	OB-67	553716.00	4190067.00	37.854811100	27.610138140
	4	OB-56A	553253.00	4190558.57	37.859268550	27.604911520
	5	OB-56B	553261.91	4190557.58	37.859259110	27.605012730

I.3. Locations of technical infrastructural units, administrative and social units, and other units under the project (individual distances to residential areas and illustration thereof on map)

Gürmat Elektrik Üretim A.Ş. plans to erect "Efe-7 Geothermal Power Plant" on an area, the total surface area of which is 32,283.345-m², composed of Plots 121, 133, 119, 97, and 102 in Block 141 and Plot 147 in Block 245 at Seyrekkovalık Locality of Mesudiye Quarter of Germencik District of Aydın Province.

The areas where the activities of the project to be carried out are private-registered lands belonging to Gürmat Elektrik Üretim A.Ş., and the surface areas of these plots are given in the following table.

Table 7. Surface area information

Block/Plot no	Surface
Block 141 / Plot 121	6,115.17
Block 141 / Plot 133	4,008.52
Block 141 / Plot 119	6,345.36
Block 141 / Plot 97	1,463.32
Block 141 / Plot 102	407.32
Block 245 / Plot 147	48,569.91

The satellite image of the plots to be used within the scope of the project is given in Figure 9.



Figure 9. Plots of the project

Source: <https://parselsorgu.tkgm.gov.tr>

The locations of the units planned within the scope of Efe-7 Geothermal Power Plant Project are indicated on the Layout Plan in Annex-6.

The project site is located approximately 19 km west of Aydın city center. The air distance of the plant to Germencik district center is 630 meters.

The residential area closest to the project site is Germencik District which is located approximately 630 m northwest. The locations of other residential areas are as follows: Reisköy Quarter is 1.9 km southwest of the project site, Mesudiye Quarter is 4.8 km northeast, Akçeşme Quarter is 6 km northeast, Erbeyli Quarter is 5.6 km east, and Sınırteke Quarter is 5.4 km east. The distance of the activity area to Aydın city center is approximately 19 km. Access to the project site can be provided via the İzmir-Aydın highway (D-550).

The residential areas in and around the project site as well as the distances to these residential areas are given in the following table.

Table 8. Details regarding the other residential areas around the project site

RESIDENTIAL UNIT	DIRECTI	DISTANCE (m)
Germencik		
Germencik District	Northwest	630
Ömerbeyli Quarter	Northeast	4,800
Reisköy Quarter	Southwest	1,900
İncirliova District		
Sınırteke Quarter	Southeast	5,400
Akçeşme Quarter	Northwest	6,000
Erbeyli Quarter	East	5,600

The satellite image showing locations of the residential areas with respect to "Efe-7 Geothermal Power Plant" (EIA area) is given in Figure 10.

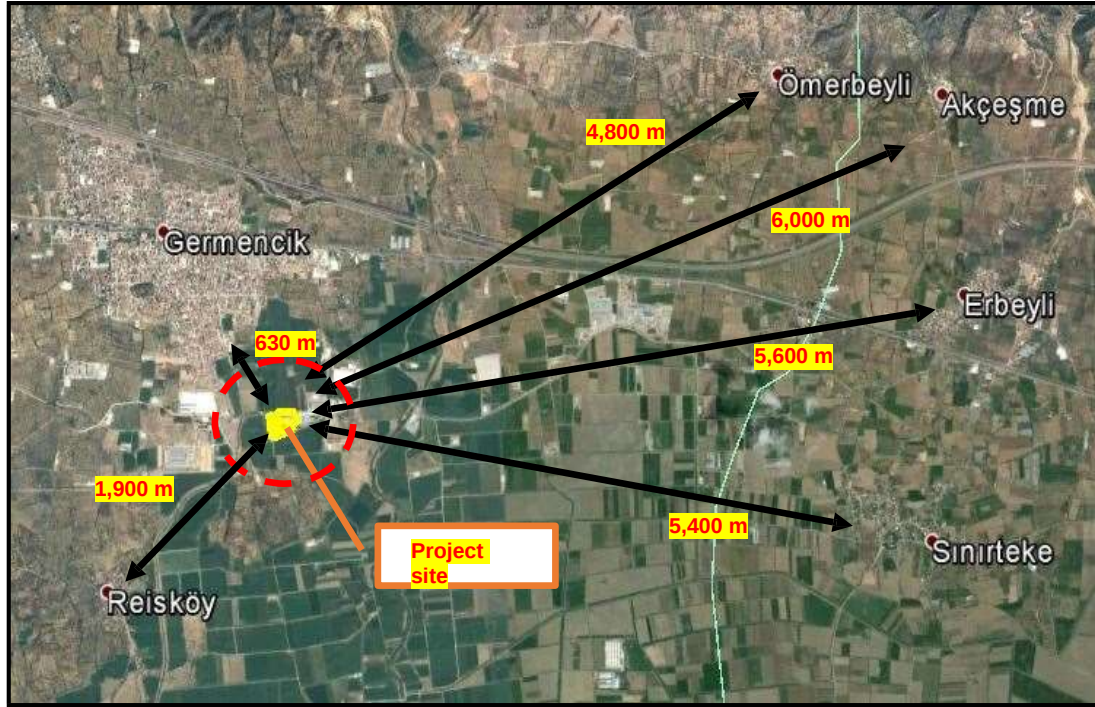


Figure 10. Satellite image showing the project site and the distances of the residential areas closest to the project site

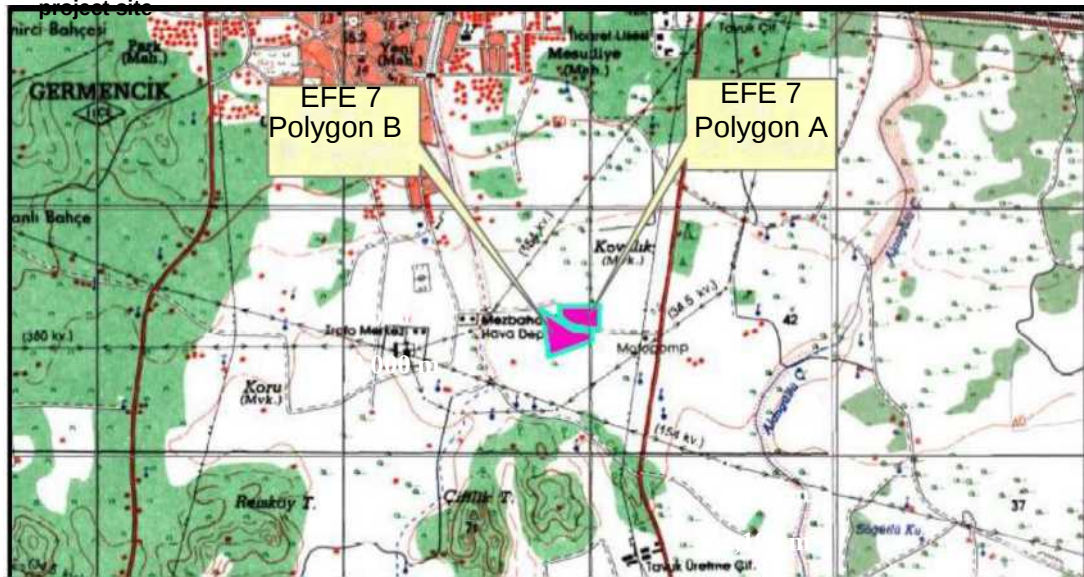


Figure 11. Topographic map showing the project site

The Site Location Map showing the project site is in Annex-1. Some photos of the activity field are in Annex-7, and the 1/25,000-scale topographical map is presented in Annex-2.

The plots intended to be used for Efe-7 Geothermal Power Plant are at the south of Efe-2 Geothermal Power Plant, which is currently being operated, whereas the pool facility belonging to Efe-2 GPP is planned to be used jointly with Efe-7 Geothermal Power Plant.

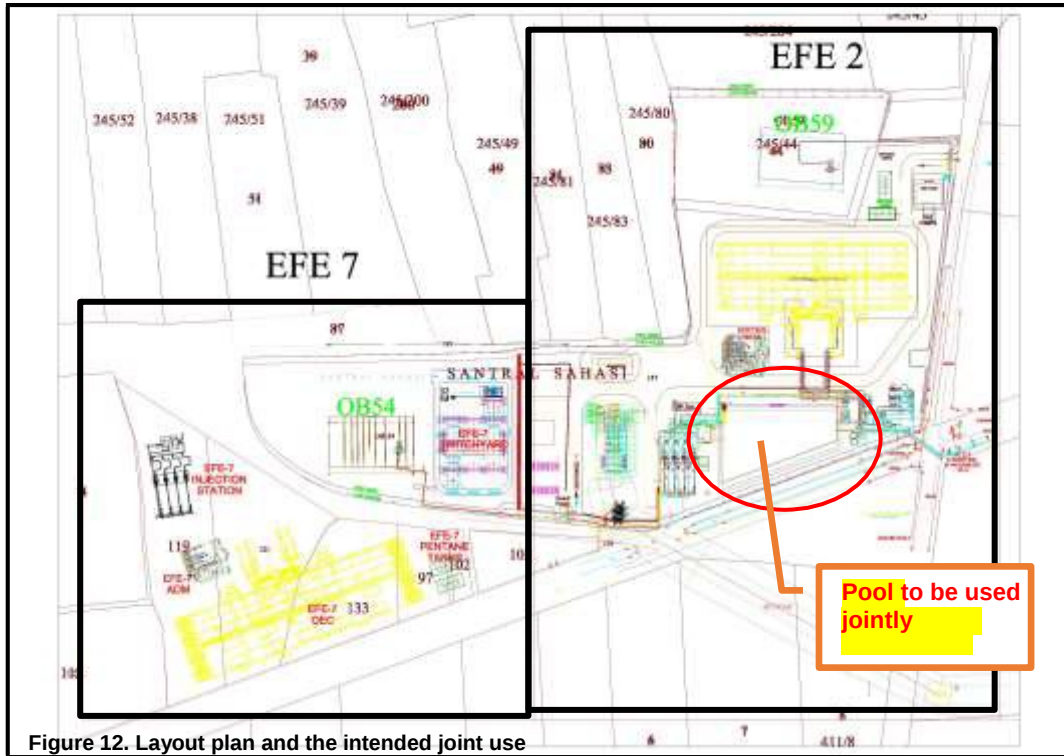


Figure 12. Layout plan and the intended joint use

The geothermal fluid to be produced at a rate about 1,500 tons/hour by 10 production wells to be drilled within the scope of the project is planned to be used by Efe-7 Geothermal Power Plant. The geothermal source to be used by the plant will be re-pumped to underground by means of 5 reinjection wells.

I.4. Technical characteristics of the project (plant's main production, power generation capacity during the operation phase of the plant, types and quantities of raw and auxiliary materials to be used in the plant, etc.)

The 25-MW installed power in this project will be operated as Binary type, and the electrical energy to be generated in the plant will be transmitted to the national system. Approximately 200,000,000 kWh of annual generation is planned under the Efe-7 GPP project.

The geothermal fluid to be used will convey from production wells to the plant in a completely sealed system. After the separation of water and steam, electricity will be obtained from the steam and water remaining from energy generation will re-pumped to underground through reinjection wells.

Under the scope of EFE-7 Geothermal Power Plant project, geothermal energy will be generated by the system known as double-fluid (binary cycle) system. Details of the intended project are given in Table 9.

Table 9. Project details

License details	
License No	J-553
Plant's surface area	32,283.345 square meter
Technology	Binary System
Installed Power	25 Mw
Point of connection to power transmission line	154 kV (154 kV Germencik substation)
Electricity generation amount	200 GWh/year
Production wells	10 wells
Reinjection wells	5 wells
Maximum geothermal fluid amount	1,500 tons/hour
Cooling tower	52 Fan and Hood Sets (air-cooled)
Number of storage pools	1 pool
Storage capacity of storage pool	6 hours
Volume of storage pool	9,000 m ³
Service life	30 years

The fluid coming from the production wells will firstly be separated into steam and liquid phases in the separator under the binary system. The two fluids separated into the steam and liquid phases will then be sent to the evaporators and in these evaporators, the liquid, which has already been increased in temperature, will convert the secondary work fluid into the steam without physically mixing.

The secondary work fluid which is converted into steam will be dispatched to the turbine and energy will be generated by the generator connected to the turbine. The secondary fluid in the form of exhaust steam from the turbine will be sucked in the air-cooled condenser and cooled down, and sent to the preheater via the circulating pump.

In the preheater, the secondary fluid exchanging heat with the primary fluid which has lost some of its temperature in the evaporator will be transferred to the evaporator by increasing its temperature close to its boiling temperature.

The geothermal fluid dispatched to the preheater will lost some heat more after bringing the secondary work fluid to a temperature close to its boiling temperature, and be sent to the reinjection wells.

The most important factor determining the efficiency and life of the geothermal source is the flow at a certain level and quantity of the geothermal fluid to the plant where it is going to be used. For this reason, "reinjection" will be applied in order to prevent reservoirs geothermal wells feeding the plant from being decreased. Thus, pressure drop and heat loss caused by the decrease of the reserve will be prevented. The plant shall not be commissioned before the reinjection process is put into operation. Attention shall be paid not to damage the freshwater aquifers during both production and reinjection.

The reinjection of thermal water is a method that has been used in geothermal fields in the world since 1969, and ensures stability of geothermal well pressures in addition to many more advantages in reservoir and geothermal fields.

Reinjection is part of the production in geothermal power plants and although it is considered to cause an additional cost, it is a very important application for the operation of geothermal power plants with high gain. A very small portion of geothermal energy can be used in geothermal reserves of power plants without reinjection application due to the pressure drop and loss of heat caused by the reduction of the reserve.

The geothermal fluid, which loses its temperature and pressure by separating from its steam before the steam turbine, shall be pumped underground using the reinjection method by maintaining its physicochemical properties.

A simplified schematic representation of binary systems is given below. Binary systems utilize a secondary working fluid with low boiling temperature and low vapor pressure at low temperatures. This secondary fluid operates in accordance with a conventional Rankine cycle. Binary systems can operate at inlet temperatures in the range of 80-170 ° C with a suitable working fluid.²

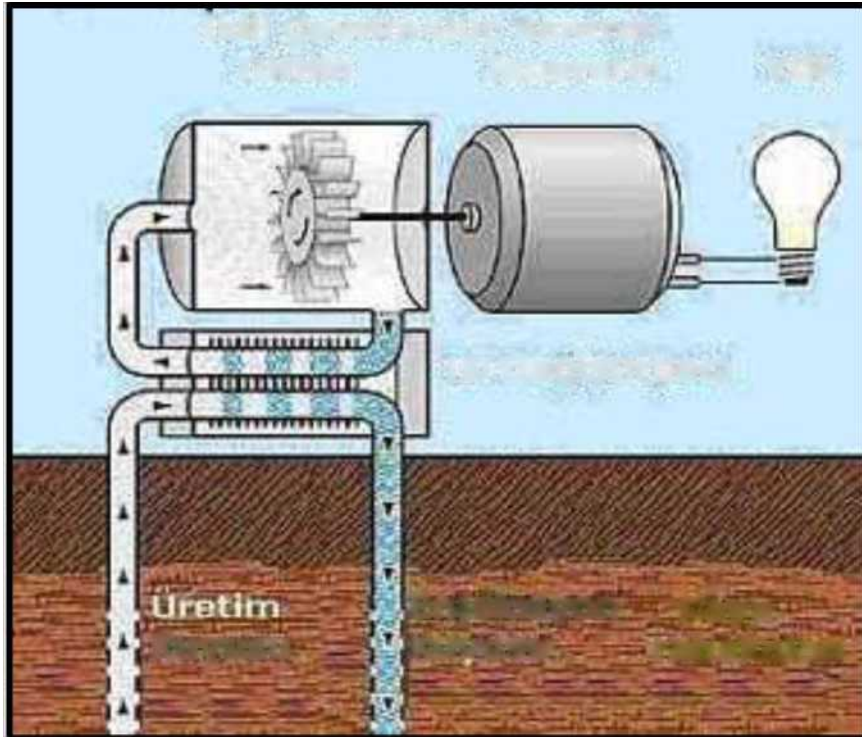


Figure 13. Schematic View of the Binary System

Source: General Directorate of Renewable Energy, <http://www.eie.gov.tr/>

Turbines, Generator

High-pressure secondary work fluid in the gas phase coming to the turbines enables rotation of the turbine blades and the kinetic energy produced in this way shall be converted into electrical energy in the generator. Each turbine inlet shall be equipped with control valves and system control shall be provided. The cooling water system that provides cooling of the bearings and oil in the system shall provide cooling of the bearing components and oils of the turbines and the generator.

²General Directorate of Renewable Energy, <http://www.eie.gov.tr/>

Production and Injection System

In this system, the geothermal fluid shall be collected from the production wells and transported to the separation station. The geothermal fluid in gas and liquid form to be separated from each other shall be sent to the vaporizer.

Superheating of the secondary work fluid in the vaporizer shall be ensured. The liquid geothermal fluid to be discharged from vaporizer will be sent to the preheaters and the transition of the secondary work fluid to the gas phase will be ensured. The liquid geothermal fluid discharged from the preheater shall be transferred to the injection wells by means of the reinjection pumps and will be re-injected to the reservoir.

Non-condensing Gas Outlet System

The non-condensing gases discharged from the vaporizer are removed from the system by means of a silencer on the air-cooled condenser.

Air Cooled Condenser

This system shall be used for cooling the secondary work fluid discharged from the turbine and converting it to the liquid phase.

Circulation Pump and Recuperator

The secondary work fluid in the liquid phase discharged from the air-cooled condenser shall be pumped to the recuperator via the circulation pumps and shall continue to flow towards the preheater by loading the heat energy of the secondary work fluid in the gas phase directed to the air-cooled condenser in the recuperator.

Auxiliary Systems

In addition to the main systems mentioned above, auxiliary systems have been designed to provide the necessary system for the supply of the domestic water required for the plant site and for the fire protection of the plant equipment. It consists of domestic water supply and fire response systems and fire water storage tank.

Power Plant Instrument Control System

It is a system composed of power plant control and protection system, monitoring instruments control valves and panels, which are installed for the protection, automation and management from the control room.

Air System

It is a system consisting of compressors, dryers and tanks, which are installed to supply the compressed air required by the control valves.

Wellhead Systems

They are composed of pipe materials and brackets used in the structure of geothermal wells and wellhead main valves, inhibitor systems to prevent scaling of pipes, control valves and silencer used in test processes and floodgates to be used in the wellhead in order to control and regulate the flow in the wellhead.

Machinery and Equipment To Be Used Within The Scope Of The Project

The process of converting the mechanical energy, which is generated by the effect of rotation as a result of the turbo pumping of the steam acquired from sending the dual phase fluid to be supplied with the production wells in the operation stage of Efe-7 GPP project to the pressure separators and separating them, into electric energy by means of generators and transmission of it to the switchyard and then to the transmission lines shall be realized.

Within the scope of the project, the production wells, reinjection wells and the places where the power plant will be installed are different and the machinery and equipment to be used in each unit will be separate. However, the plots planned for the Efe-7 Geothermal Power Plant are located in the south of the Efe-2 GPP areas operating in the present situation and the usage of pool shall be provided in common for both.

The machinery and equipment planned to be used in the production well and well head plant is listed below:

- Inhibitor dosing system
- Well head control valves
- Separator
- Balance tank
- Filters
- Pumps
- Measuring equipment
- Manual valves
- Safety equipment
- Compressor
- Drive panels
- Automation panel

The machinery and equipment to be used in the reinjection wells wellhead plant are;

- Reinjection Pumps
- Manual valves and check valves
- Measuring equipment
- Safety equipment
- Drive panels
- Automation panels
- Frequency controller panel
- Break chambers
- Transformer

Machine-equipment to be used in the plant;

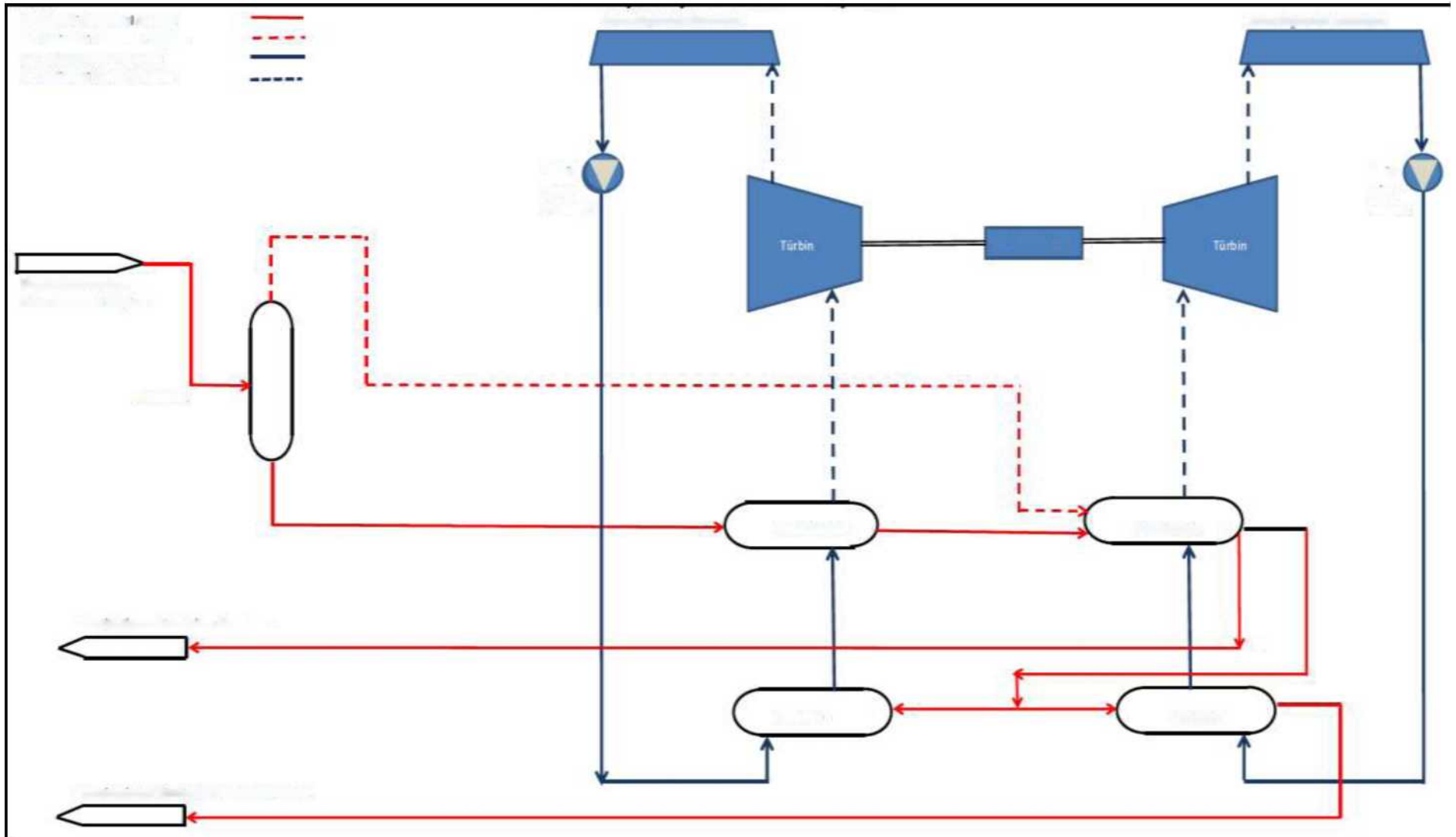
- Exchangers
- Recuperators
- Turbines
- Transformer

The flow chart of the process planned to be implemented in the Efe-7 Geothermal Power Plant project is shown in Figure 14 and Figure 15.

The main production to be realized within the scope of Efe-7 GPP project is electric energy. The electrical energy to be produced within the scope of the planned operation will be approximately 200.000.000 kWh / year. The production capacity of the planned project is detailed in Table.10.

EFE-7 25,00 MW BINARY POWER PLANT ANNUAL PRODUCTION SPREADSHEET

EFE-7 25,00 MW BINARY POWER PLANT ANNUAL PRODUCTION SPREADSHEET														
		January	February	March	April	May	June	July	August	Septemb	October	Novembe	Decemb	
Average Zone Temperature	C	8.10	8.90	11.70	15.70	20.90	26.00	28.40	27.20	23.20	18.40	12.90	9.40	
Average Relative Humidity	%	71.00	67.00	66.00	63.00	57.00	49.00	50.00	56.00	57.00	62.00	68.00	72.00	
Total power	MW	27.95	27.95	27.74	26.91	26.13	22.73	22.21	21.68	24.82	26.78	27.82	27.64	
ORC Total Consumption	MW	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	
Total Other Loads (BTP + Reinj.)	MW	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	
Transmission Line Losses	MW	0.70	0.70	0.69	0.67	0.65	0.57	0.56	0.54	0.62	0.67	0.70	0.69	
Net Power	MW	23.93	23.93	23.73	22.92	22.15	18.84	18.33	17.82	20.88	22.79	23.81	23.63	
Day:		31	28	31	30	31	31	30	31	30	31	30	31	
Hour:		744	672	744	720	744	744	720	744	720	744	720	744	
Total Production	MWh	20,798	18,785	20,642	19,374	19,437	16,910	15,989	16,133	17,870	19,923	20,033	20,564	
Net Production	MWh	17,808	16,084	17,656	16,500	16,481	14,017	13,198	13,259	15,032	16,955	17,141	17,580	
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			
Annual Net Production	MWh	187,126	185,623	184,120	180,754	178,912	185,022	183,519	182,016	178,671	178,710			
Notes:														
1 - Total Other Loads includes consumptions of re-injection pumps, transfer pump and other equipment.														
2 - It is considered that 2 weeks of stops will be in question in 5th and 10th years of the power plants for overhaul maintenance.														
3 - Annual productivity loss is taken as 0.8%.														
4 - TEIAS transmission loss is taken as 2.5%.														
5 - Production license 25 MW production value is taken into account in planning.														



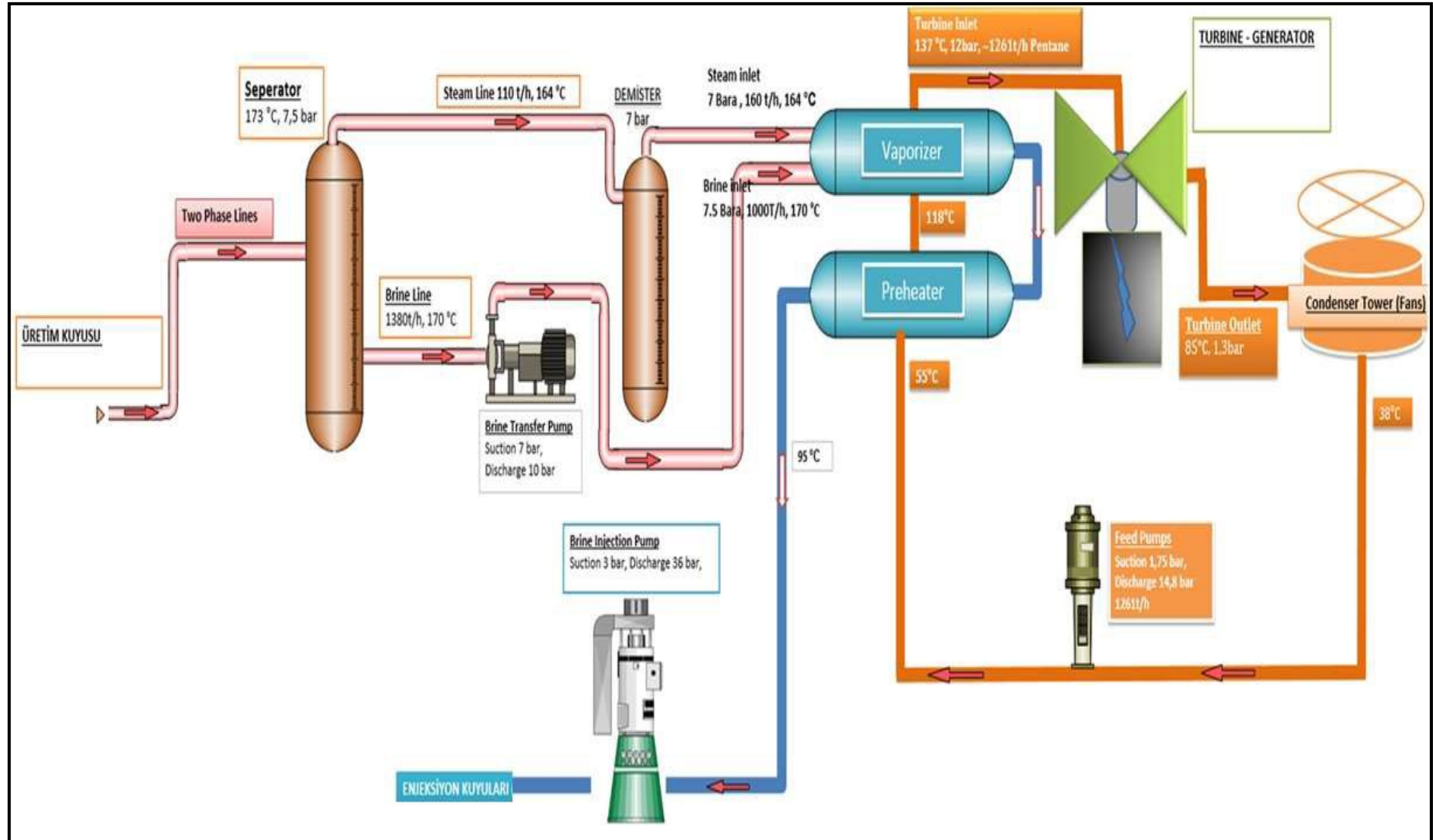


Figure 15. Process Flow Diagram Schematic

I.5. Economic Characteristics of the Project (Relevant Investment Program, Financial Resources, Where These Resources Are Available, Work Flow Chart or Time Table Benefit-Cost Analysis)

The planned investment program encompasses the necessary expenditures including project designing, research, construction, production and reinjection wells from the first phase of the project to the operation phase.

Total investment amount of Efe-7 Geothermal Power Plant Project was determined as 62,500,000 TL.

Approximately 20% of the financial resources required for the Efe-7 Geothermal Power Plant Project shall be covered by the owner's equity while the remaining 80% will be covered by getting loans from national and international banks.

Turkey's industrial and economic development depends indirectly on meeting the rapidly increasing demand for energy. It is obvious that the economic additions to the country's production capacity will serve the interests of the domestic industry. Within the scope of the project, it is aimed to contribute to electricity production in our country, though partially.

The time table for the planned activity is presented in Table.11.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Table 11. Timeline Table

Benefit Cost Analysis

Cost / benefit analysis is an important indicator of whether a project is economically viable. In this context, while the benefit-cost analysis of the Efe-7 Geothermal Power Plant Project are carried out; evaluations shall be made separately in terms of the investor company, the region where the project will be applied and our country.

Benefit-Cost Analysis in terms of the Investor Company

The following assumptions were made in the calculations made for economic evaluation of the planned capacity increase project.

The economic life of the geothermal power plant, considered within the subject of the project, is 30 years. In this context, operating costs can be defined as fuel, maintenance and repair and direct expenses. An important part of these expenses is maintenance and repair, and financial costs.

As a result of the economic analysis and financing evaluation carried out according to these assumptions, the planned project will pay for itself in about 5-7 years after the commencement of the operation. In this respect, the project is an economic investment for the country's economy and also for the investor.

Cost-Benefit Analysis in terms of The Region and Our Country

In parallel with the rapidly growing industry and economic development of our country, there is an increasing energy demand. It is obvious that the economic investments to be made towards the production capacity of our country will serve the interests of the domestic investors and our people.

The energy policy of our country is to provide all its users with reliable, good quality and clean energy at the right time in order to support healthy and economic development. For this purpose, it is expected that all domestic and imported energy resources will be used, and all domestic and foreign private and public investment and finance facilities will be used to provide the energy needed to meet energy demands in an economical and reliable manner.

Ensuring continuity and reliability in electricity production will contribute to the development of the country. Efe-7 Geothermal Power Plant Project is expected to provide economic development and employment opportunities to the region. The personnel, materials and service need to be met from the region during the construction and operation phase of the project will contribute positively to the regional economy.

I.6. OTHER ISSUES

There are no other issues required to be mentioned in this report.

SECTION II

ENVIRONMENTAL CHARACTERISTICS OF THE PROJECT LOCATION AND THE CURRENT IMPACT AREA

SECTION II: ENVIRONMENTAL CHARACTERISTICS OF THE PROJECT LOCATION AND THE CURRENT IMPACT AREA

(In This Section, The Impact Area Shall Be Considered When Presenting The Environmental Characteristics Of The Site Selected For The Project.) When Describing The Issues Listed In This Section, The Relevant Public Institutions And Institutions, Research Institutions, Universities Or Other Institutions From Which The Information Is Obtained And The Sources Of The Information Is Specified In The Notes Section Of The Report Or Added To The Relevant Map, Document Etc. If the Project Owner wants to provide information based on his own research, a document indicating the accuracy of this information, which is received from the relevant public institutions and organizations for those which are within the scope of the authority of Public Institutions and Organizations, is attached to the report)

II.1. Determination of the Impact Area of the Project (How And According To Which Criteria The Impact Area Was Determined Shall Be Explained And The Impact Area Shall Be Demonstrated On The Map)

Efe-7 Geothermal Power Plant, which is in total 25 MW installed power for the aim of electric energy output through utilizing geothermal source in Aydın Province, Germencik District, Mesudiye Neighbourhood, Seyrekkovalık location, is planned to be established and operated by Gürmat Elektrik Üretim A.Ş.

In geothermal power plant projects, the fact that the energy source is a geothermal reservoir is a condition which causes limitation of the alternatives to be utilized . The selection of the boundaries of the field of activity was determined in accordance with the geological, hydrogeological and geomorphological location of the site and the potential of the project to interact with the economic, social, biological and physical environment. Environmental, economic and social factors need to be considered together when determining the impact area of the project.

The technology to be used in the operational phase of the activity is a modern and applicable technology and is still being implemented in similar facilities. Therefore, it is considered that the technology chosen for energy production shall provide optimum conditions. The technology level of the project shall be compatible with the studies to be done during the minimization stage of the possible environmental impacts arising from the project.

The impact area of the Efe-7 GPP project is determined as 500 m from the perimeter of the power plant area. There is no settlement area within the said impact area. There are agricultural lands and the current geothermal power plant in the impact area.

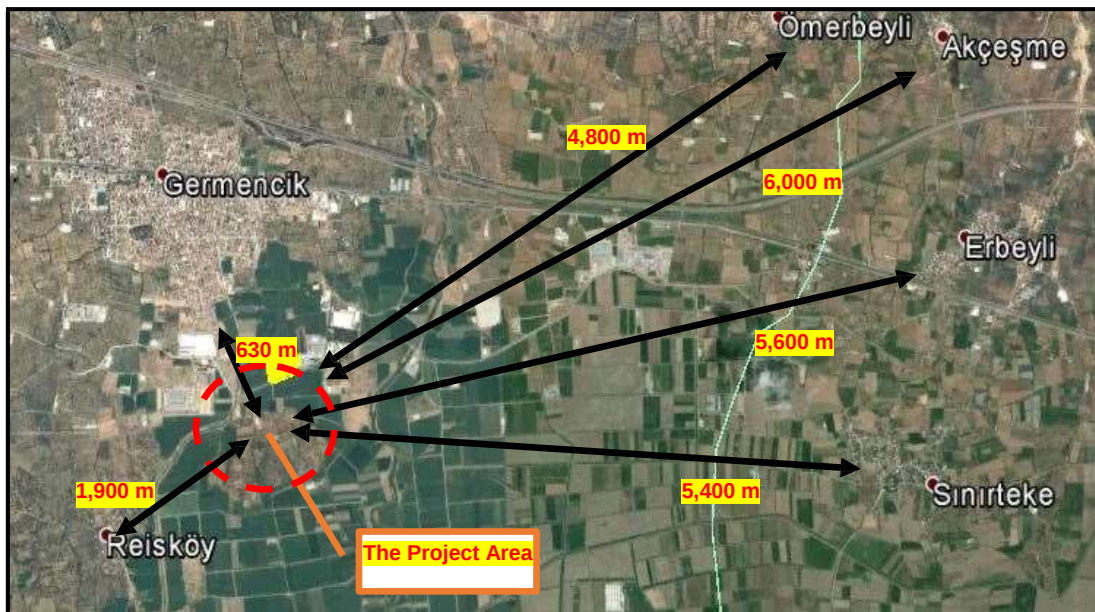


Figure 16. The Satellite Image Showing the Project Area and The Distance of the Nearest Settlement Areas to the Project Area

The table indicating the locations of the settlement areas with respect to the project subject "Efe-7 Geothermal Power Plant" (EIA Area) is given below.

Table 12. Distances to Other Settlement Areas Around the Project Area

Settlement Area	Direction	Distance
Germencik District		
Germencik District	Northwest	630
Ömerbeyli Neighbourhood	Northeast	4.800
Reisköy Neighbourhood	Southwest	1.900
İncirliova District		
Sınırteke Neighbourhood	Southeast	5,400
Akçeşme Neighbourhood	Northwest	6,000
Erbeyli District	East	5,600

The nearest settlement to the project area is the Germencik District Centre, which is located 630 m northwest.

The environmental impacts that will arise from the production and reinjection wells occur within the location areas and do not extend beyond this area. Therefore, the impact area for the wells to be used within the scope of the geothermal power plant is estimated as the well location boundaries where the wells are located.

The Site Location Map demonstrating the project area is provided in Annex-1. The photographs of the activity area are presented in Annex-7 and the 1/25,000 scaled topographic map is presented in Annex-2.

The impacts of the planned project on the specified settlement areas are discussed in the relevant sections of this EIA Report.

II.2. Characteristics of Physical and Biological Environment within the Impact Area and Use of Natural Resources

II.2.1. Meteorological and Climatic Characteristics (General Climatic Characteristics, Temperature Distribution, Distribution Of Precipitation , Humidity Distribution, Evaporation Condition, Distribution Of Counted Days (Foggy, Snowy, Covered With Snow, Maximum Snow Cover Thickness Etc), Wind Distribution, Wind Speed Distribution, Stormy Days, Strong Windy Days Of The Location Where The Activity Will Take Place-The Information Under This Title Will Include Monthly, Seasonal and Annual Distributions, The Meteorological Data Set Will Be Comprehensive to Include The Long Term)

General Climate Conditions of the Region

In the province of Aydın, where the project is located, summers are hot and dry, and winters are mild and rainy. The Büyük Menderes valley, like the other Aegean plains, is in the form of a groove opening towards the sea in the west. Therefore, the warming effect of the sea and the winds bringing rain can easily reach to the inland region.

The Mediterranean climate is generally widespread due to the influence of the Aegean Sea, which is a side extension of the Mediterranean Sea; summers are dry and hot, winters are warm and rainy. Almost all precipitation in the province is observed in the form of rain. Because of its proximity to the Aegean Sea and the mountains being perpendicular to the sea, the effect of the Mediterranean temperate climate reaches to the inner part of the region. Although the climate in the province does not show great differences, continental climate is seen as the coast gets further away.

The results of continuous meteorological measurements carried out by the General Directorate of Meteorology (MGM) are analysed and the results of the most suitable meteorological stations are presented with the help of tables and graphs in order to evaluate meteorological conditions in the project area and surrounding areas. In this context, the data obtained from the Aydın Meteorological Station between 1960 and 2015, as well as the largest precipitation values observed at the standard times and the precipitation-intensity-duration and recurrence curves were used and the related documents are given in Annex-8.

Pressure Distribution

According to Aydın Meteorology Station 1960-2015 data, the annual average pressure was 1006.9 hPa, the annual maximum pressure was 1028.7 hPa in January, and the annual minimum pressure was 975.4 hPa in January.

The pressure data are presented in Table.13 and the graphical representation of the data is presented in Figure.17.

Table 13. Pressure Data of Aydın Meteorological Station

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average Pressure (hPa)	1010.6	1009.2	1008.0	1006.1	1005.6	1003.8	1001.3	1001.9	1005.8	1009.2	1011.0	1010.9	1006.9
Max Pressure (hPa)	1028.7	1026.1	1024.4	1023	1015.1	1012.7	1010.4	1009.0	1016.1	1019.9	1023.8	1026.9	1028.7
Minimum Pressure (hPa)	975.4	984.1	985.9	989.1	993.9	992.5	994.1	995.0	997.4	995.4	994.7	985.2	975.4

Source: Aydın Meteorology Station, 1960-2015 Data.

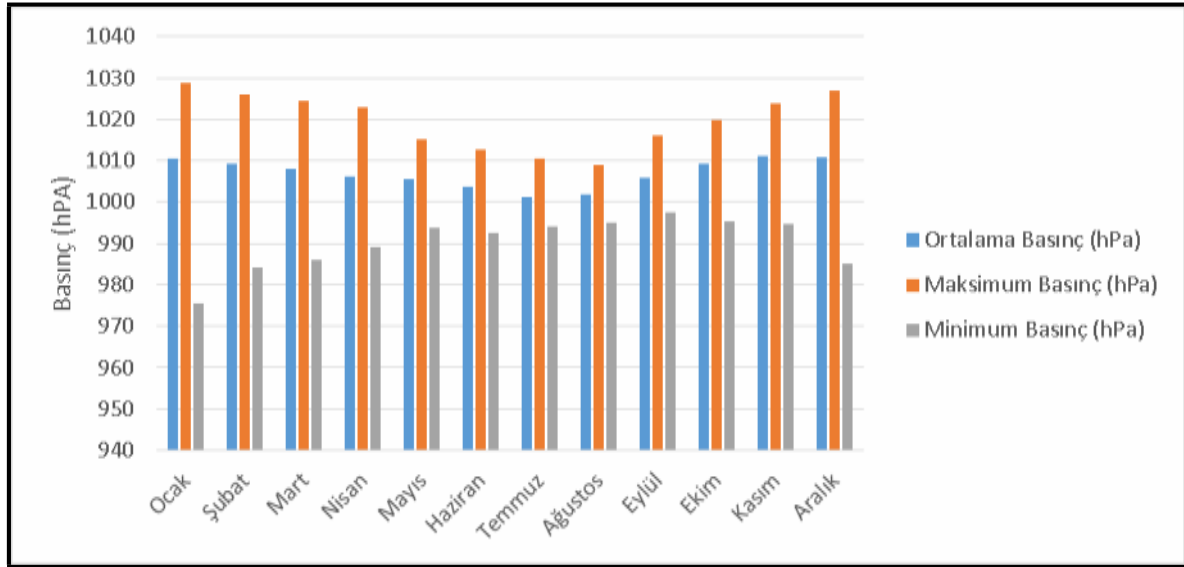


Figure 17. Aydın Meteorology Station Pressure Value Chart

Temperature Distribution

According to Aydın Meteorology Station 1960-2015 data, the annual average temperature is 17.7 °C. The highest temperature was determined in July at 44.6 °C. The lowest temperature was determined in January at -7.6 °C. The temperature data are presented in Table.14 and the graphical representation of the data is presented in Figure.18.

Table 14. Long Term Temperature Data

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average Temperature (°C)	8.2	9.2	11.9	15.8	20.9	25.9	28.4	27.5	23.4	18.5	13.3	9.6	17.7
Maximum Temperature (°C)	23.2	25.2	32.4	35.4	40.2	44.4	44.6	43.8	43.3	37.8	30.7	25.4	44.6
Minimum Temperature (°C)	-7.6	-5.2	-5	-0.8	4.6	8.4	13.4	11.8	7.6	2	-2	-5.2	-7.6

Source: Aydın Meteorology Station, 1960-2015 Data.

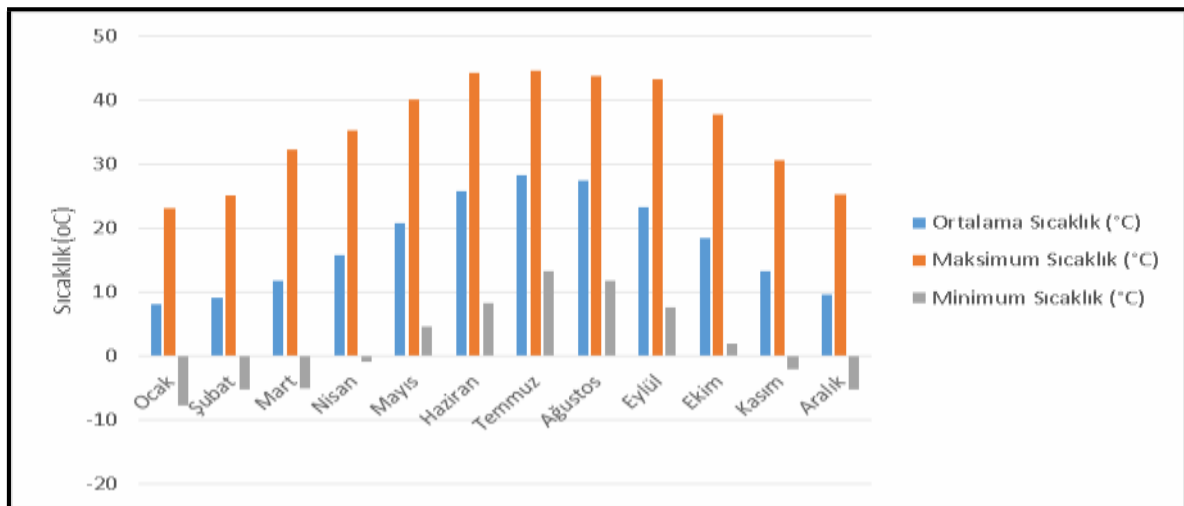


Figure 18. Monthly Temperature Distributions Chart from Aydın Meteorology Station

Precipitation

According to Aydın Meteorology Station 1960-2015 data; the annual precipitation amount was determined as 634.5 mm.

The Precipitation data of Aydın Meteorology Station are presented in Table.15 and the graphical representation of the data is presented in Figure.19.

Table 15. Aydın Meteorology Station's Long-Term Precipitation Data

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Total Precipitation Average (mm)	104.6	94.1	69.1	55.1	35.1	13.9	3.2	1.9	12.3	42.9	79.8	122.5	634.5
Maximum Precipitation (mm)	93.8	54.8	68.2	48.2	92	46	29.3	20.3	31.8	86.9	65.9	80.2	93.8

Source: Aydın Meteorology Station, 1960-2015 Data.

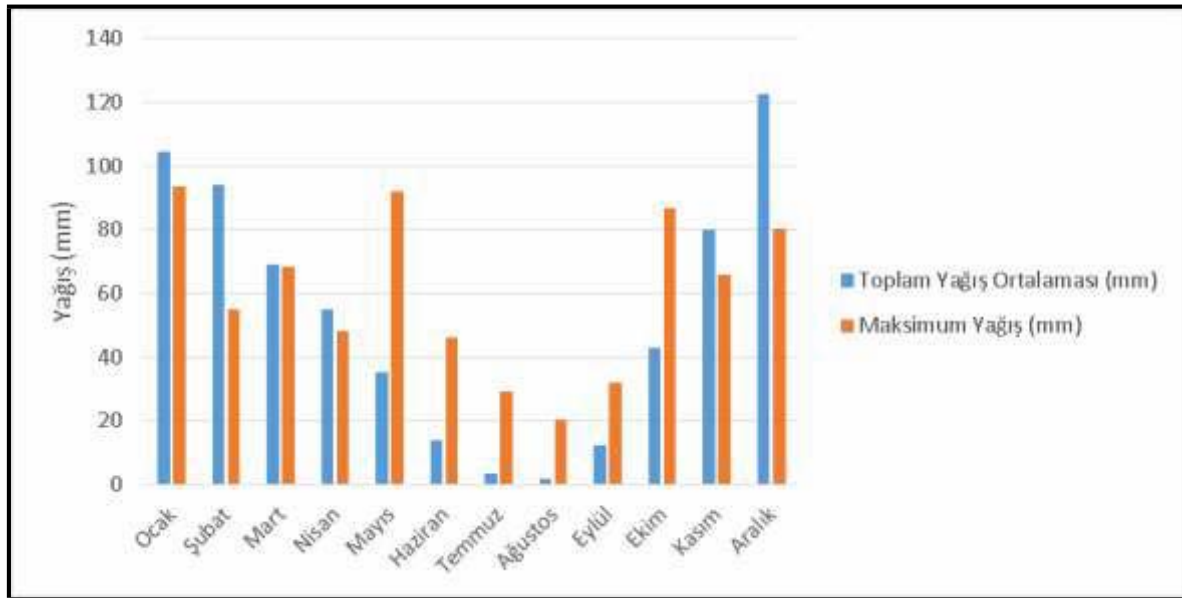


Figure 19. Aydın Meteorology Station Precipitation Value Chart

Humidity Distribution

According to the observation records of Aydın Meteorology Station between 1960 and 2015, the annual average of humidity was determined as 61.9%. The lowest humidity was measured in July at 4%.

The humidity values of Aydın Meteorological Station between 1960 and 2015 are given in Table.16 and the graphical representation of the data is given in Figure.20.

Table 16. Relative Humidity Values From Aydın Meteorology Station

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average Humidity (%)	72.4	69.7	66.5	63.4	57.5	49.8	48.5	52.5	56.3	63.2	69.6	73.8	61.9
Lowest Humidity (%)	15	15	11	6	7	9	4	9	10	10	12	13	4

Source: Aydın Meteorology Station, 1960-2015 Data.

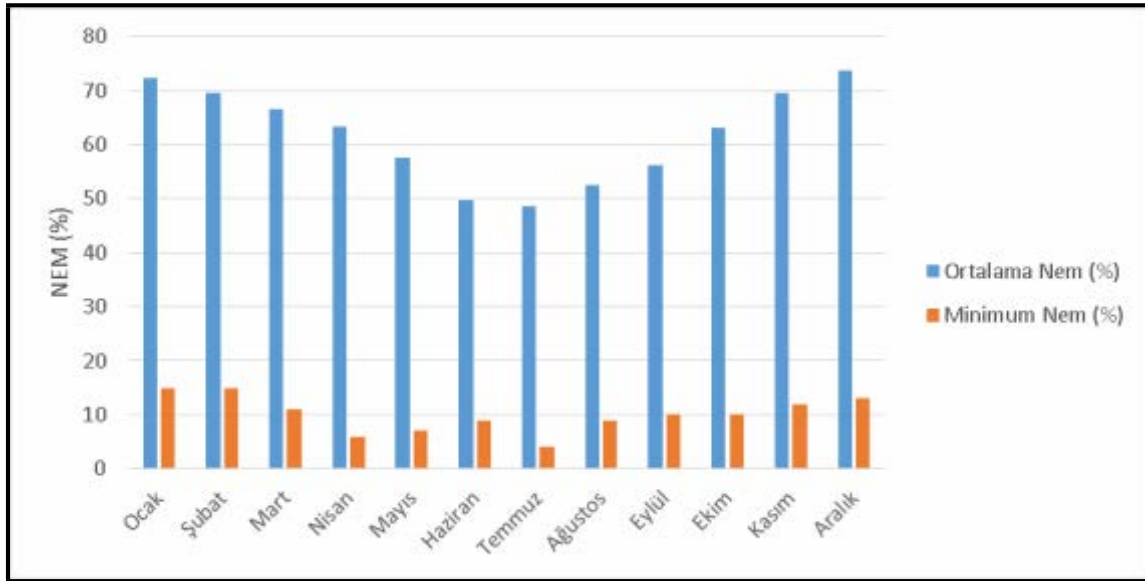


Figure 20. Aydın Meteorology Station Graphical Representation of the Minimum and Average Humidity Data

Counted Days

According to the observation records of the Aydın Meteorological Station Between the years of 1960 and 2015, the annual number of snowy days 10.4; annual number of foggy days is 36.4; the annual number of hail days is 1.2; the annual number of hoar frosty days is 12; The annual number of thunder stormy days is 15.3.

The Counted Days data of Aydın Meteorology Station are presented in Table.17 and the graphical representation of the data is presented in Figure.21 and Figure 22.

Table 17. Counted Days Data of Aydın Meteorological Station

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Number of Snowy Days	0.3	0.1	0.1									0.1	0.15
Snow Covered Days	0.1	0	0									0	0.02
Average number of foggy days	0.2	0.2	0.2	0.1	0				0	0.1	0.1	0.3	0.13
Average Number of Hail Days	0.3	0.3	0.2	0.2	0.2	0.1		0	0	0.1	0	0.1	0.13
Average number of hoar frosty days	6.8	4.8	3	0.2						0.1	1.9	4.7	3.07
Average number of thunder stormy days	1.9	2	1.8	2.5	3.2	2	0.8	0.6	1.3	1.7	2.2	2.4	1.86

Source: Aydın Meteorology Station, 1960-2015 Data.

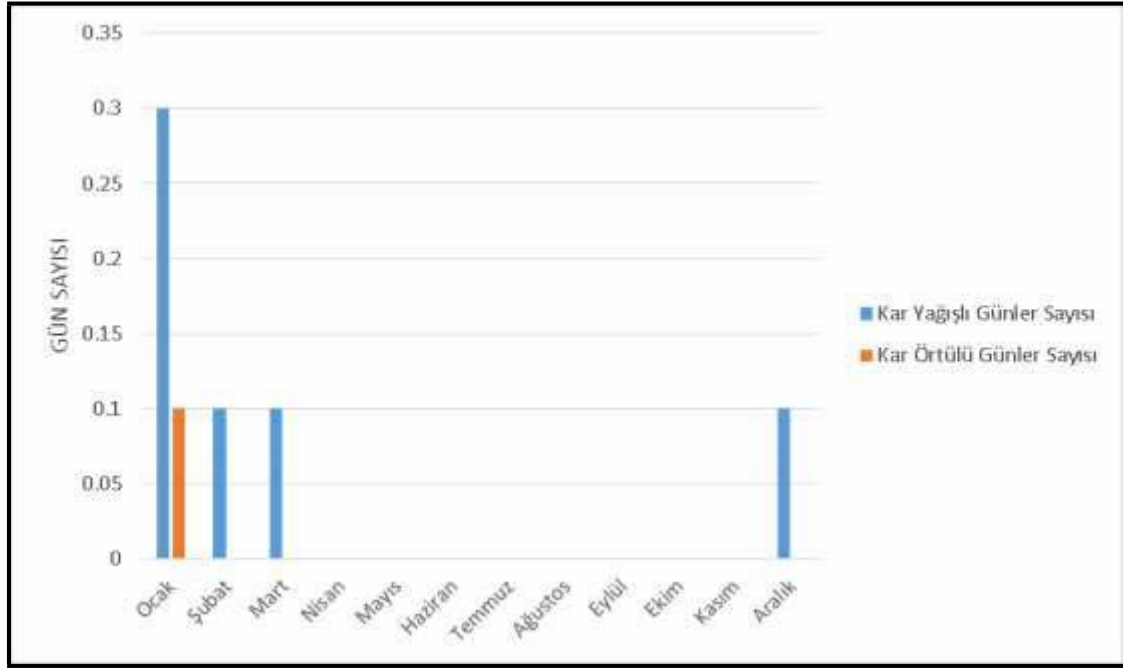


Figure 21. Snowfall and Snow-Covered Day Numbers Chart of Aydın Meteorological Station

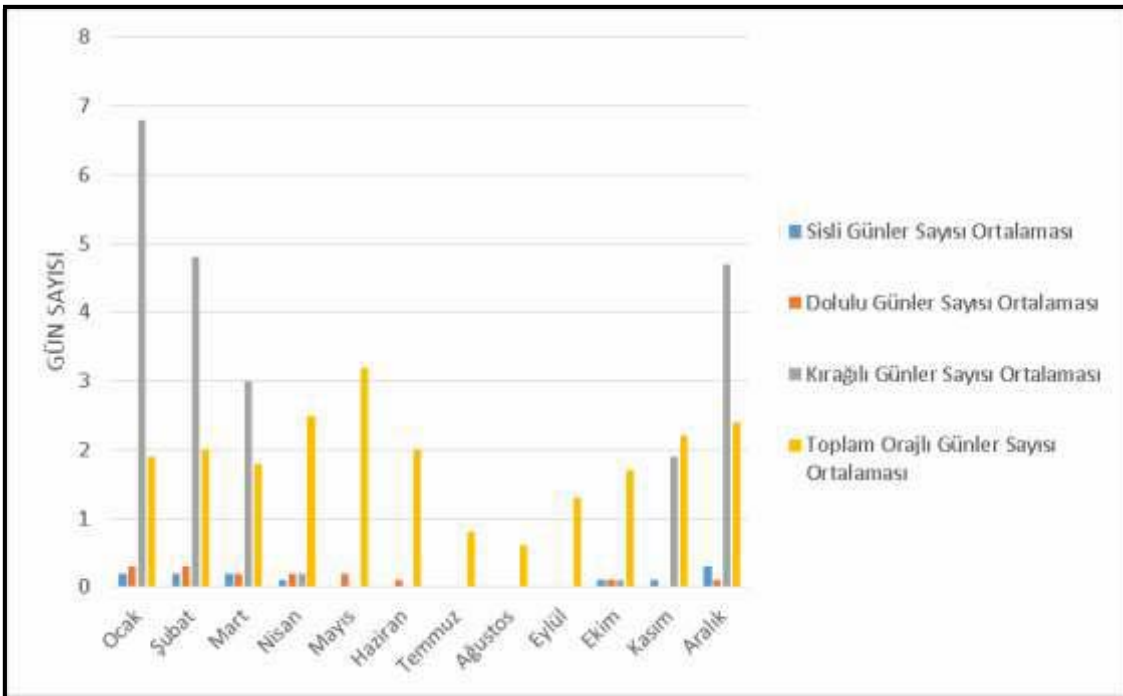


Figure 22. Foggy, Hail, Hoar Frosty, Total Thunder Stormy Day Numbers Chart of Aydın Meteorological Station

Maximum Snow Thickness

According to the observation records of Aydın Meteorology Station between 1960 and 2015, the maximum annual snow thickness is seen in January at 6 cm. The chart showing the distribution by months is presented in Figure.23 and the values are given in Table.18.

Table 18. Maximum Snow Thickness (cm) of Aydın Meteorological Station

METEOROLOGICAL PARAMETER	MONT												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Maximum Snow	6	4	1									2	6

Source: Aydın Meteorology Station, 1960-2015 Data.

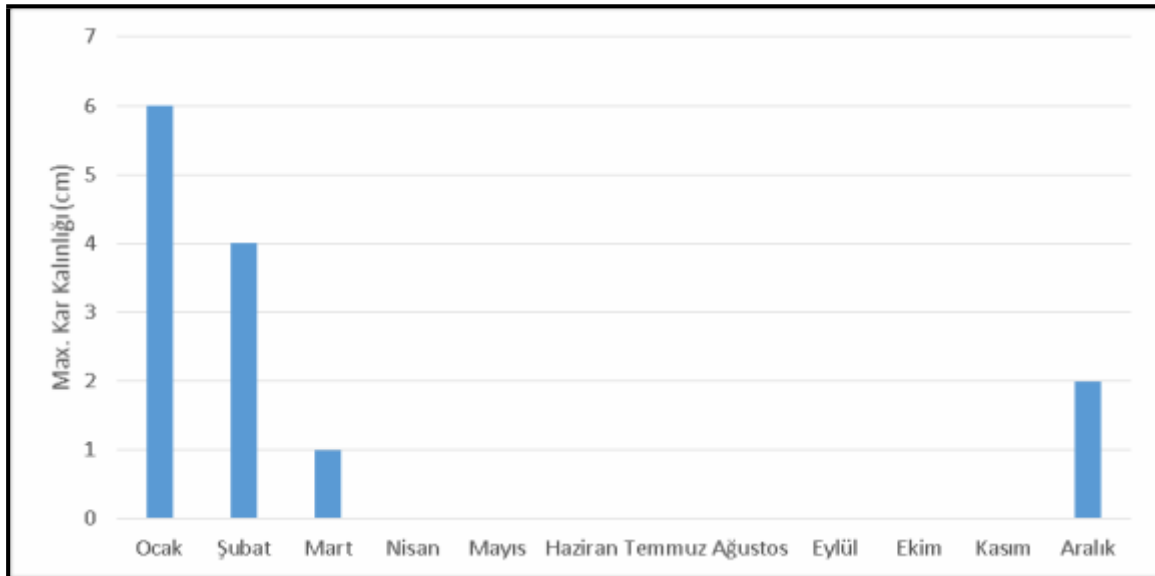


Figure 23. Maximum Snow Thickness Distribution By Months Chart of Aydın Meteorological Station

Evaporation Condition

According to observation records of the Aydın Meteorological Station between 1960 and 2015, the average number of open surface evaporations is measured as 119.1 mm and the maximum open surface evaporation was measured as 13.7 mm in August. The corresponding values are shown in Table.19, and the graphical representation is shown in Figure.24.

Table 19. Aydın Meteorology Station Evaporation Data

METEOROLOGICAL PARAMETER	MONT												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average Open Surface Evaporation (mm)	15.1	18	43.2	104.4	169	230.4	268.9	242.7	169.9	103.3	42.8	21.2	119.1
Maximum Open Surface Evaporation (mm)	9.4	11.3	8	11	11.5	13.7	16.8	13.5	10.4	9.6	9	5.8	13.7

Source: Aydın Meteorology Station, 1960-2015 Data.

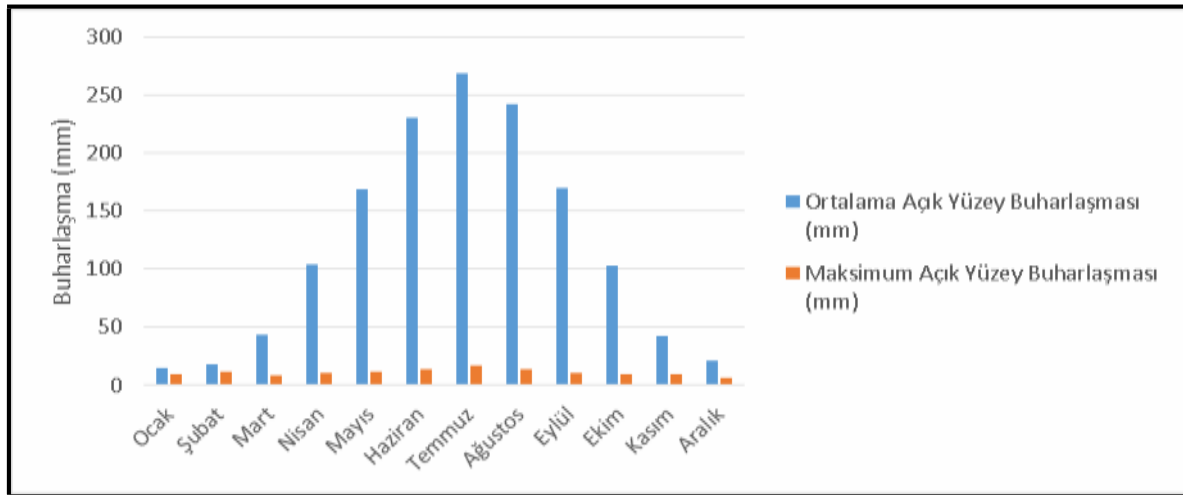


Figure 24. Aydın Meteorology Station Graphical Representation of Average and Maximum Open Surface Evaporation Data

Wind Distribution

According to wind counts of the Aydın Meteorological Station between 1960 and 2015, first degree dominant wind direction is E (East), second degree dominant wind direction is ESE (East Southeast), third degree dominant wind direction is W (West).

Average Wind Speed

According to the observation records of Aydın Meteorology Station between 1960 and 2015, the annual average of wind speed is 1.74 m/s.

Monthly average wind speed data of Aydın Meteorology station is shown in Table.20 and the graphical representation of the data is presented in Figure.25.

Table 20. Aydın Meteorology Station Monthly Average Wind Speed Data

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average Wind Speed (m/s)	1.7	1.7	1.7	1.8	1.9	2	2	1.9	1.7	1.4	1.4	1.7	1.74

Source: Aydın Meteorology Station, 1960-2015 Data.

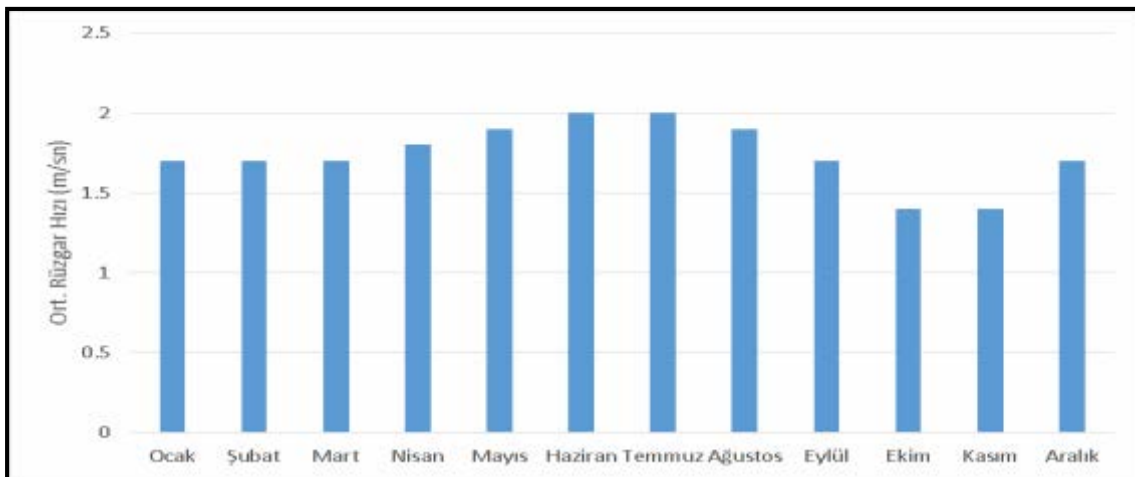


Figure 25. Aydın Meteorology Station Monthly Average Wind Speed Chart

Fastest Blowing Wind Direction and Speed

According to the observation records of Aydın Meteorology Station between 1960 and 2015, maximum blowing wind direction is WSW (West Southwest) and its speed is 28 m/s.

The fastest blowing wind direction and speed data of Aydın Meteorology Station is shown in Table.21 and the graphical representation of the data is presented in Figure.26.

Table 21. Aydın Meteorology Station Fastest Blowing Wind Direction and Speed Data

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Maximum Wind Speed (m/s)	23.4	28	27.5	29.5	21.5	22.3	21.7	25.6	26.4	27.5	25.5	25.9	28
Maximum Wind Direction	E	WSW	SW	SSE	SSW	NNE	NE	SE	S	WNW	SW	W	E

Source: Aydın Meteorology Station, 1960-2015 Data.

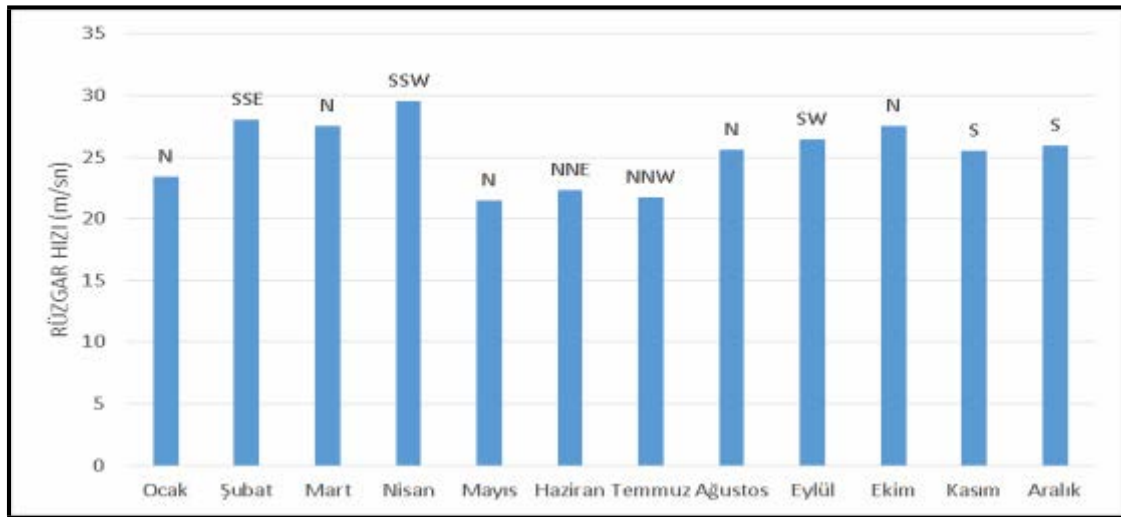


Figure 26. Aydın Meteorological Station Maximum Wind Speed Chart

Number of Stormy and Strong Windy Days

According to the observation records of Aydın Meteorology Station between 1960 and 2015, the annual average of stormy days is 0.31. Annual average of strong windy days is 4.73.

The data of the number of stormy and strong windy days are shown in Table.22 and the graphical representation of the data is presented in Figure 27.

Table 22. Aydın Meteorology Station Number Stormy and Strong Windy Days Data

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Number of Stormy Days	0.7	0.5	0.6	0.3	0.1	0.2	0.3	0.3	0.2	0.1	0.1	0.4	0.31
Strong Windy Days Average	4.4	4.3	4.4	4.6	4.6	5.7	6.7	6.6	5.2	2.7	3	4.5	4.73

Source: Aydın Meteorology Station, 1960-2015 Data.

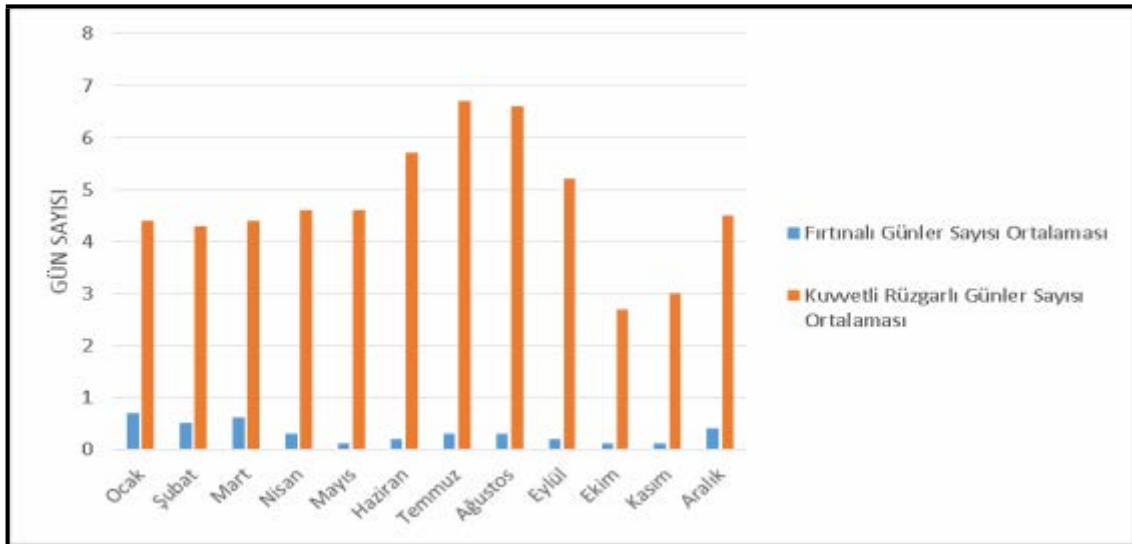


Figure 27. Aydın Meteorology Station Stormy and Strong Windy Days Chart

Annual, Seasonal, Monthly Distribution of Wind Direction

According to the observation records of Aydın Meteorology Station between 1960 and 2015, the average speed of the wind by directions is given in Table.23 and the total number of wind counts is given in Table.24. The annual wind diagram by wind counts is given in Figure.28.

Table 23. Average Speed of Wind by Directions

DIRECTION	METEOROLOGICAL PARAMETER	MONTHS												ANNUAL
		JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	
N	Average Speed of Wind (m/s)	1.1	1.2	1.2	1.3	1.4	1.7	2	1.9	1.4	1.1	0.9	1	1.35
NNE	Average Speed of Wind (m/s)	0.9	1.1	1	1.1	1.1	1.4	1.8	1.5	1.4	0.9	0.9	0.8	1.16
NE	Average Speed of Wind (m/s)	1.1	1.2	1.2	1.2	1.2	1.3	1.5	1.3	1.1	1	0.9	1	1.17
ENE	Average Speed of Wind (m/s)	1.4	1.4	1.3	1.2	1.1	1.1	1.1	1	1	1.1	1.3	1.4	1.20
E	Average Speed of Wind (m/s)	1.9	1.9	1.7	1.6	1.4	1.4	1.2	1.3	1.3	1.5	1.7	1.9	1.57
ESE	Average Speed of Wind (m/s)	1.7	1.7	1.6	1.5	1.3	1.2	1.1	1.1	1.3	1.4	1.5	1.7	1.43
SE	Average Speed of Wind (m/s)	1.4	1.5	1.3	1.3	1.2	1.1	1.1	1	1	1.1	1.2	1.4	1.22
SSE	Average Speed of Wind (m/s)	1	1.2	1.2	1.2	1.2	0.9	1	1	0.9	0.9	0.9	1	1.03
S	Average Speed of Wind (m/s)	1.1	1.3	1.4	1.3	1.4	1.3	1.3	1	1.1	1	1	1.1	1.19
SSW	Average Speed of Wind (m/s)	0.9	1.2	1.2	1.5	1.4	1.3	1.3	1.4	1.1	1	0.9	1	1.18
SW	Average Speed of Wind (m/s)	1.2	1.2	1.4	1.5	1.6	1.6	1.7	1.8	1.5	1.1	1	1	1.38
WSW	Average Speed of Wind (m/s)	1.2	1.3	1.6	1.7	1.7	1.7	1.9	2	1.9	1.4	1.1	1	1.54
W	Average Speed of Wind (m/s)	1.3	1.5	1.8	2.1	2.3	2.3	2.4	2.4	2.2	1.6	1.3	1.3	1.88
WNW	Average Speed of Wind (m/s)	1.1	1.3	1.6	1.9	1.9	2	2	2	1.9	1.5	1.2	1.2	1.63
NW	Average Speed of Wind (m/s)	1.1	1.2	1.5	1.6	1.7	2	1.9	1.7	1.6	1.2	1.1	1.1	1.48
NNW	Average Speed of Wind (m/s)	0.9	1.1	1.2	1.3	1.5	1.7	1.8	1.6	1.3	1	0.9	0.8	1.26

Source: Aydın Meteorology Station, 1960-2015 Data.

Table 24. Total Number of Wind Counts By Directions

DIRECTION	METEOROLOGICAL PARAMETER	MONTHS												ANNUAL
		JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	
N	Total Number of Wind Counts	1154	1340	1200	1044	1132	1275	1130	908	699	783	1153	1307	13125
NNE	Total Number of Wind Counts	1078	1145	1006	849	836	861	1135	984	1036	1097	1326	1187	12540
NE	Total Number of Wind Counts	1849	1636	1519	1172	1107	1015	889	833	802	1320	1762	1760	15664
ENE	Total Number of Wind Counts	5223	4074	3169	2692	2264	2089	1732	1725	2247	3744	4888	5842	39689
E	Total Number of Wind Counts	13111	10241	9227	7557	7042	6014	5194	6304	7208	9293	11970	14408	107569
ESE	Total Number of Wind Counts	6317	5189	5041	4064	3598	2976	3554	3741	3944	4958	5248	6034	54664
SE	Total Number of Wind Counts	1734	1502	1482	1392	1335	1392	1598	1401	1270	1091	1327	1685	17209
SSE	Total Number of Wind Counts	599	564	658	677	590	616	888	820	589	572	477	522	7572
S	Total Number of Wind Counts	623	606	792	824	772	881	1017	786	745	586	550	589	8771
SSW	Total Number of Wind Counts	494	587	836	920	851	916	1325	1311	927	602	452	452	9673
SW	Total Number of Wind Counts	866	1018	1492	1961	2162	2351	3060	3002	2374	1651	891	772	21600
WSW	Total Number of Wind Counts	1409	1699	2503	2713	2734	3189	4398	4391	3919	2847	1608	1075	32485
W	Total Number of Wind Counts	1929	2409	4121	4729	6318	6323	6581	6774	5792	4473	2430	1427	53306
WNW	Total Number of Wind Counts	1457	2114	3789	4500	5405	5021	4917	4424	4347	3807	2068	1373	43222
NW	Total Number of Wind Counts	763	1019	1601	1966	2289	2212	1426	1298	1313	1347	1079	794	17107
NNW	Total Number of Wind Counts	824	1007	1178	1293	1290	1405	1122	750	735	871	981	800	12256

Source: Aydın Meteorology Station, 1960-2015 Data.

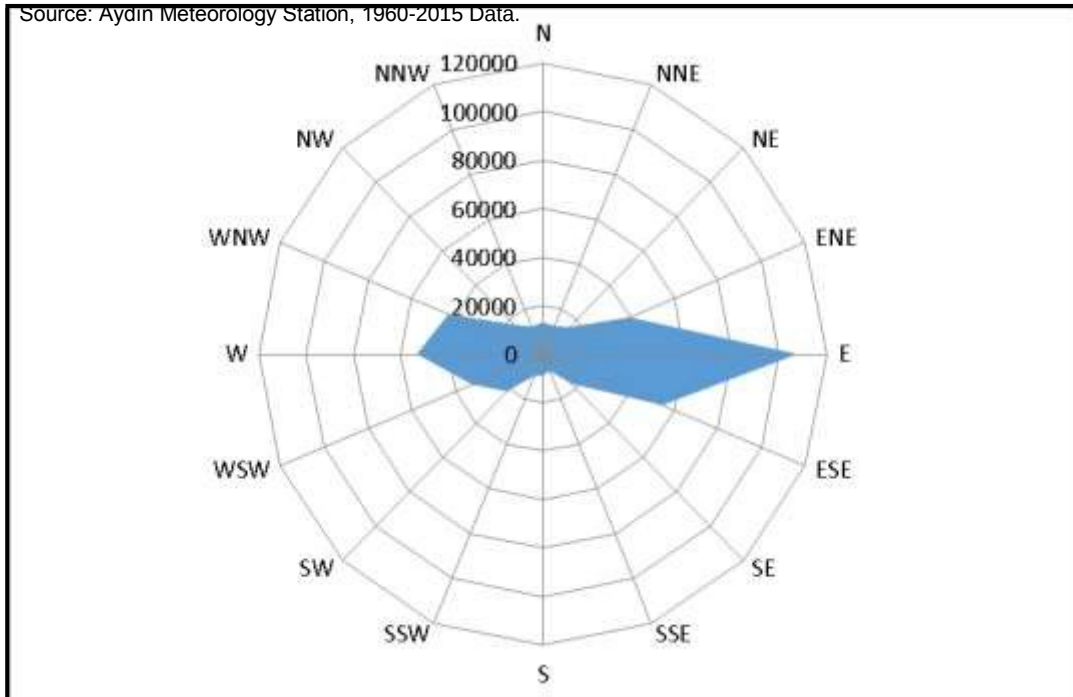


Figure 28. Aydın Meteorology Station Annual Wind Diagram By Wind Counts

The annual wind diagram by average wind speed is given in Figure.29.

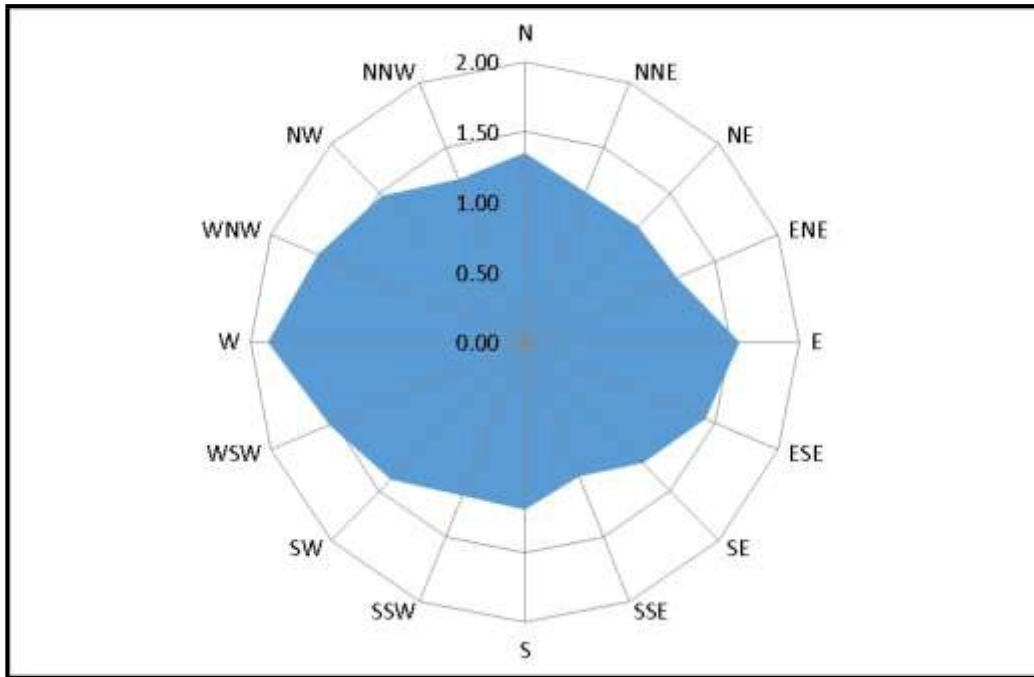


Figure 29. Aydın Meteorological Station Annual Wind Diagram By Average Wind Speed

According to Aydın Meteorology Station observation records, the total number of seasonal wind counts by directions is given in Table.25, seasonal wind diagrams by the wind counts are given in Figure 30.

Table 25. Aydın Meteorology Station Total Number of Seasonal Wind Counts By Directions

METEOROLOGICAL PARAMETER		WINTER	SPRING	SUMMER	AUTUMN
N	Total Number of Wind Counts	3801	3376	3313	2635
NNE	Total Number of Wind Counts	3410	2691	2980	3459
NE	Total Number of Wind Counts	5245	3798	2737	3884
ENE	Total Number of Wind Counts	15139	8125	5546	10879
E	Total Number of Wind Counts	37760	23826	17512	28471
ESE	Total Number of Wind Counts	17540	12703	10271	14150
SE	Total Number of Wind Counts	4921	4209	4391	3688
SSE	Total Number of Wind Counts	1685	1925	2324	1638
S	Total Number of Wind Counts	1818	2388	2684	1881
SSW	Total Number of Wind Counts	1533	2607	3552	1981
SW	Total Number of Wind Counts	2656	5615	8413	4916
WSW	Total Number of Wind Counts	4183	7950	11978	8374
W	Total Number of Wind Counts	5765	15168	19678	12695
WNW	Total Number of Wind Counts	4944	13694	14362	10222
NW	Total Number of Wind Counts	2576	5856	4936	3739
NNW	Total Number of Wind Counts	2631	3761	3277	2587

Source: Aydın Meteorology Station, 1960-2015 Data.

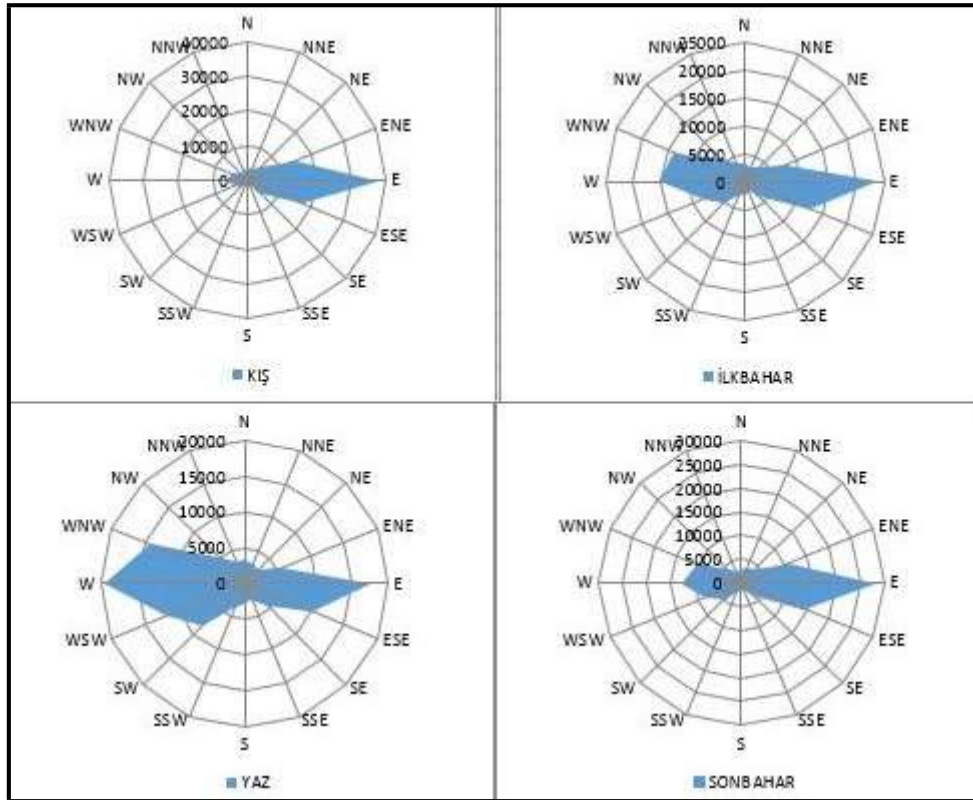


Figure 30. Aydın Meteorology Station Seasonal Wind Diagram By Wind Counts

Monthly wind diagrams by wind counts of Aydın Meteorology Station are given in Figure.31.

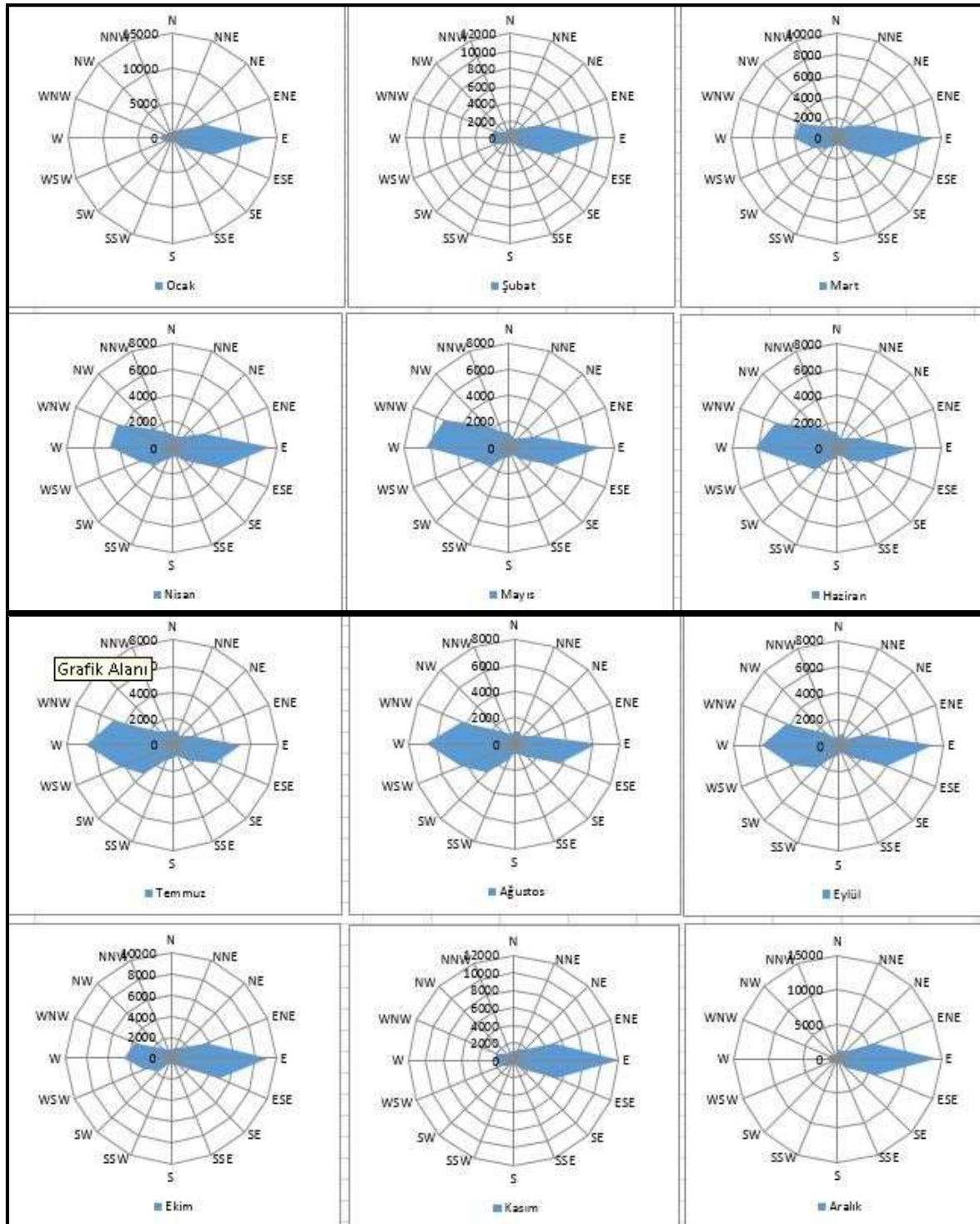


Figure 31. Aydın Meteorology Station Monthly Wind Diagrams By Wind Counts

Extreme Event Observation (FEVK) Records

The highest precipitation values and precipitation-intensity-duration-recurrence curves and extraordinary event observation (Fevk) records were obtained from the Ministry of Forestry and Water Affairs, General Directorate of Meteorology.

Table 26. Aydın Meteorology Station Extreme Event Observation (FEVK) Records

DATE	PLACE	EVENT	LOSS
15.10.1977	Aydın	Precipitation and Flood	Agricultural products were damaged due to precipitation and flooding
30.10.1980	Aydın	Hail	Hail damaged the agricultural products
16.12.1981	Aydın	Precipitation and Flood	Agricultural products were damaged due to overflow of creeks.
11.02.1984	Aydın	Precipitation and Flood	The agricultural products and settlement areas were damaged due to overflow of creeks.
16.05.1998	Aydın	Precipitation and Flood	Agricultural products were damaged due to precipitation and flooding
24.05.2003	Aydın	Hail	Crop lodging and grain pull-out
06.03.2004	Aydın	Hoar Frost	Crop lodging
07.03.2004	Aydın	Hoar Frost	Crops damaged due to frost
14.11.2004	Aydın	Storm	Communication and power transmission lines were damaged
30.05.2005	Aydın	Hail	Vegetable gardens were damaged
26.02.2006	Aydın	Hail	Industrial crops were damaged
24.06.2007	Aydın	High temperature	Forest fire outbreak
27.06.2007	Aydın	High temperature	Stream water level decreased or dried
01.09.2007	Aydın	High temperatures	Stream water level decreased or dried
22.11.2008	Aydın	Storm	Settlement areas were damaged
23.11.2008	Aydın	Storm	Settlement areas were damaged
02.01.2009	Aydın	Precipitation and Flood	Crop lodging
23.01.2009	Aydın	Storm	Human animal transport and settlement areas were damaged
26.01.2009	Aydın	Hail	Vegetable gardens were damaged
09.02.2009	Aydın	Hail	Highway transportation disrupted
19.02.2009	Aydın	Precipitation and Flood	Cultivated agricultural areas were flooded
26.01.2010	Aydın	Frost	Trees were damaged due to frost
16.10.2010	Aydın	Precipitation and Flood	Settlement areas were damaged
10.12.2010	Aydın	Precipitation and Flood	Human animal transport and settlement areas were damaged
22.01.2011	Aydın	Precipitation and Flood	Cultivated agricultural areas were flooded
17.05.2011	Aydın	Hail	Highway transportation disrupted
10.06.2011	Aydın	Hail	Highway transportation disrupted
16.06.2011	Aydın	Hail	Branches of the trees were broken.
07.10.2011	Aydın	Precipitation and Flood	Industrial crops were damaged
09.10.2011	Aydın	Tornado	People have suffered
07.12.2011	Aydın	Precipitation and Flood	Railway transportation disrupted
25.01.2012	Aydın	Precipitation and Flood	Cultivated agricultural areas were flooded
30.05.2012	Aydın	Precipitation and Flood	Railway transportation disrupted
03.06.2012	Aydın	Hail	Fruits on trees fell off
03.04.2013	AYDIN	Full storm (24.5-28.4 m/s)	Human - animal - transport and settlements were damaged
17.07.2013	AYDIN	Strong storm (20.8-24.4 m/s)	Trees uprooted
01.10.2013	AYDIN	Storm Tornado	Trees uprooted
02.10.2013	AYDIN	Heavy rain Flood Deluge	Human animal transport and settlement areas were damaged
27.04.2014	AYDIN	Hail	Cultivated agricultural areas were damaged.
17.09.2014	AYDIN	Heavy rain Flood Deluge	Settlement areas were damaged
13.11.2014	AYDIN	Heavy rain Flood Deluge	Settlement areas were damaged
20.11.2014	AYDIN	Heavy rain Flood Deluge	Highway transportation disrupted
08.12.2014	AYDIN	Heavy rain Flood Deluge	Settlement areas were damaged
27.12.2014	AYDIN	Heavy rain Flood Deluge	Cultivated agricultural areas were damaged.
07.01.2015	AYDIN	Frost	Cultivated agricultural areas were damaged.

31.01.2015	AYDIN	Storm Tornado	Branches of the trees were broken.
27.02.2015	AYDIN	Storm Tornado	Settlement areas were damaged
06.04.2015	AYDIN	Storm Tornado	Branches of the trees were broken.
03.06.2015	AYDIN	Heavy rain Flood Deluge	Settlement areas were damaged
03.06.2015	AYDIN	Hail	Human animal transport and settlements were damaged
06.08.2015	AYDIN	Storm Tornado	Settlement areas were damaged
22.09.2015	AYDIN	Heavy rain Flood Deluge	Human animal transport and settlements were damaged
21.10.2015	AYDIN	Heavy rain Flood Deluge	Human animal transport and settlements were damaged
15.10.1977	Aydın	Precipitation and Flood	Agricultural products were damaged due to precipitation and flooding
30.10.1980	Aydın	Hail	Hail damaged the agricultural products
16.12.1981	Aydın	Precipitation and Flood	Agricultural products were damaged due to overflow of creeks.
11.02.1984	Aydın	Precipitation and Flood	The agricultural products and settlement areas were damaged due to overflow of creeks.
16.05.1998	Aydın	Precipitation and Flood	Agricultural products were damaged due to precipitation and flooding
24.05.2003	Aydın	Hail	Crop lodging and grain pull-out
06.03.2004	Aydın	Hoar Frost	Crop lodging
07.03.2004	Aydın	Hoar Frost	Crops damaged due to frost
14.11.2004	Aydın	Storm	Communication and power transmission lines were damaged
30.05.2005	Aydın	Hail	Vegetable gardens were damaged
26.02.2006	Aydın	Hail	Industrial crops were damaged
24.06.2007	Aydın	High temperature	Forest fire outbreak
27.06.2007	Aydın	High temperature	Stream water level decreased or dried
01.09.2007	Aydın	High temperatures	Stream water level decreased or dried
22.11.2008	Aydın	Storm	Settlement areas were damaged
23.11.2008	Aydın	Storm	Settlement areas were damaged
02.01.2009	Aydın	Precipitation and Flood	Crop lodging
23.01.2009	Aydın	Storm	Human animal transport and settlement areas were damaged
26.01.2009	Aydın	Hail	Vegetable gardens were damaged
09.02.2009	Aydın	Hail	Highway transportation disrupted
19.02.2009	Aydın	Precipitation and Flood	Cultivated agricultural areas were flooded
26.01.2010	Aydın	Frost	Trees were damaged due to frost
16.10.2010	Aydın	Precipitation and Flood	Settlement areas were damaged
10.12.2010	Aydın	Precipitation and Flood	Human animal transport and settlement areas were damaged
22.01.2011	Aydın	Precipitation and Flood	Cultivated agricultural areas were flooded
17.05.2011	Aydın	Hail	Highway transportation disrupted
10.06.2011	Aydın	Hail	Highway transportation disrupted
16.06.2011	Aydın	Hail	Branches of the trees were broken.
07.10.2011	Aydın	Precipitation and Flood	Industrial crops were damaged
09.10.2011	Aydın	Tornado	People have suffered
07.12.2011	Aydın	Precipitation and Flood	Railway transportation disrupted
25.01.2012	Aydın	Precipitation and Flood	Cultivated agricultural areas were flooded
30.05.2012	Aydın	Precipitation and Flood	Railway transportation disrupted
03.06.2012	Aydın	Hail	Fruits on trees fell off
03.04.2013	AYDIN	Full storm (24.5-28.4 m/s)	Human - animal - transport and settlements were damaged
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20.11.2014	AYDIN	Heavy rain Flood Deluge	Highway transportation disrupted
08.12.2014	AYDIN	Heavy rain Flood Deluge	Settlement areas were damaged
27.12.2014	AYDIN	Heavy rain Flood Deluge	Cultivated agricultural areas were damaged.
07.01.2015	AYDIN	Frost	Cultivated agricultural areas were damaged.
31.01.2015	AYDIN	Storm Tornado	Branches of the trees were broken.
27.02.2015	AYDIN	Storm Tornado	Settlement areas were damaged
06.04.2015	AYDIN	Storm Tornado	Branches of the trees were broken.
03.06.2015	AYDIN	Heavy rain Flood Deluge	Settlement areas were damaged
03.06.2015	AYDIN	Hail	Human animal transport and settlements were damaged
06.08.2015	AYDIN	Storm Tornado	Settlement areas were damaged
22.09.2015	AYDIN	Heavy rain Flood Deluge	Human animal transport and settlements were damaged
21.10.2015	AYDIN	Heavy rain Flood Deluge	Human animal transport and settlements were damaged

The maximum precipitation values at standard times and precipitation intensity-time-recurrence curves and Extreme Event Observation (Fevk) Records shall be taken into consideration in all stages of the mentioned project.

The meteorological bulletin of Aydın Meteorology station between 1960 and 2015 and the values and graphs observed for the highest precipitation at standard times were given in Annex-8.

II.2.2. Geological Features (Regional Geology, 1 / 25.000 Scaled General Geology Map of the Site, Stratigraphic Column Sections, Geology of the Project Area, Large Scale (1 / 25.000 or 1 / 100.000 Scale) Geology Map of the Survey Area and Sections of the Units Within the Scope of the Project, Mass Movements (Landslide / Debris Flow), Sensitivity Analysis, Landslide Risk Map, Landslide Precipitation Relationship, Slope Stability, Sliding Analysis, Seismicity and Natural Disaster Potential, if any Geotechnical Survey Report of the Project)

General Geology³

The Menderes Massif, which is spread around the Western Anatolia, and the surrounding rock units outcrop within the borders of Aydın Province. For more than a century, various studies have been carried out. The first study in the region was conducted by Strickland (1840). A holistic perspective could not be reached with the many studies conducted for different purposes in the following years. Naturally, reports contain stratigraphic-structural differences. Therefore, University-MTA (Mineral Research And Exploration Institute) employees and several researchers have concentrated on certain truths aiming for solving problems with regards to core of the massif, rock units, their ages and their relationship with surrounding rocks.

³ Aydın Province Environmental Status Report for 2011

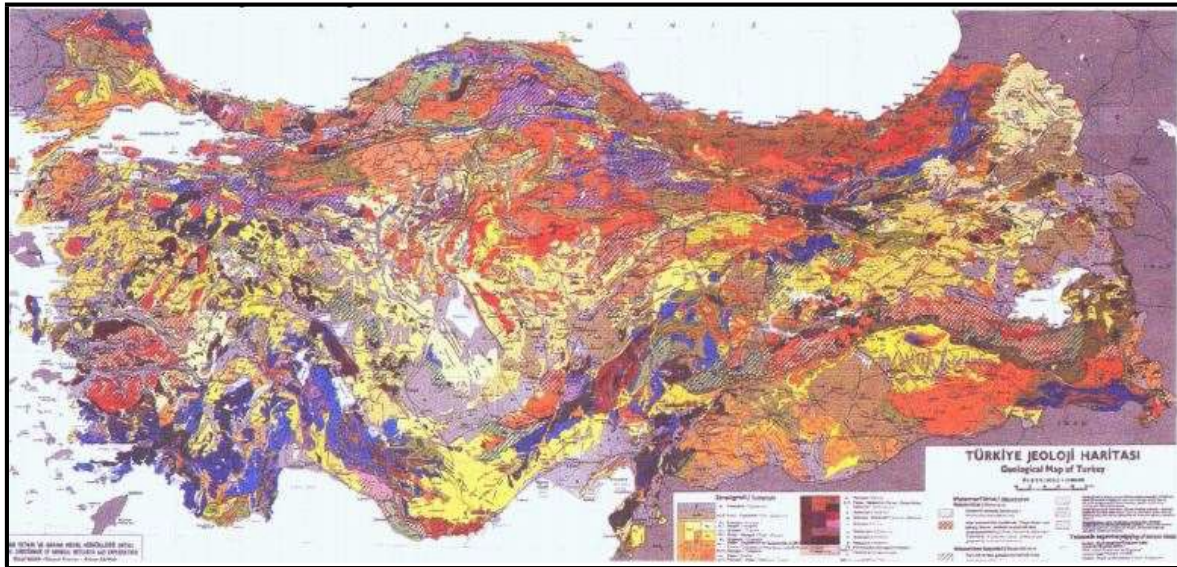


Figure 32. Geological Map of Turkey

In the light of the clarified views stated in the studies conducted in the recent years, the rocks of the three groups of the Menderes Massif, which have a discordant relationship with each other, and the Neogene cover and quaternary alluviums overlying them, as well as the Dilek peninsula-Selcuk-Tire imbricated zone, which outcrop in the western part, are present in the survey area.

Çine Group (The core of the Menderes Massif): It is composed of augen-gneiss meta granite derived from granite, augen-gneiss derived from sedimentary rock, migmatite, fine grained banded gneiss, metavolcanics and various schist which shows characteristics for metamorphism in almandine-amphibolite facies. It is Precambrian aged. The "Kavaklıdere Group" overlies on this group unconformably.

Augen-Gneiss Derived From Sedimentary Rock: They usually show rough and indeterminate foliation. Gneiss and migmatites are graded from bottom to top. The most typical feature of the rock is their augen structures with diverse forms. Augen ranging from 1-5 cm composed of Feldspar, Quartz, Muscovite, Biotite and Tourmaline groups are covered with dark minerals. Macroscopically, they have a porphyroblastic texture. They have lepidoblastic texture where the augen are partially disappear.

Migmatite: It is observed locally in lens shape between augen-gneiss derived from sedimentary rock and gneiss. It has generally banded, folded and ptigmatic augen structure and show indeterminate and rough foliation. Its mineralogical composition is similar to that of augen-gneiss derived from sedimentary rock.

Various gneiss and schist: These metamorphic rocks which are transitional with the augen-gneiss derived from sedimentary rock and the underlying migmatite form the highest level of the group. Fine grained gneiss with lateral and vertical transitions are intercalated with garnet schist, mica schist and quartz schist. In addition, amphibolite schist, calc-schist and marble bands and lens shapes are also observed.

Depending on the type of rock, the colours, alteration and erosion forms are different. In addition to quartz, plagioclase, biotite, white mica, garnet and disten minerals; tourmaline, apatite, zircon, rutile and opaque minerals are also found secondarily.

Augen-Gneiss Derived From Granite: They cut through the augen-gneiss derived from sedimentary rocks, which form the bedrock, migmatites, fine grained gneiss and different schists. They are settled in the rock as dike, sill and stock. They are also called meta granite. The rock shows very rough, indeterminate foliation and well-developed lineation. The edge zones have generally thin texture and they are very poor in terms of dark minerals. Another typical feature is the presence of radially arranged tourmalines in the edge zones. The augen, mostly composed of feldspar, are arranged parallel to the lineation and in contact with each other. All these rocks in the core of the massif mentioned above in the area of thinning are shown on the map as "Gneiss".

Metavolcanites: It was defined by the researchers as "Leptite". The sedimentary structure was mostly destroyed by severe metamorphism. Their colour is grey and light purplish. Massif rest schistosity is observed hardly. The fact that they are hardly affected by joint systems is because they are hard. They contain veins similar to pegmatite. They are similar to double micaceous gneisses due to grains that are characterized by an increase in quartz and feldspar in the veins. Migmatization in metavolcanics is also observed. They contain quartz, plagioclase, orthoclase, biotite, granite, sillimanite, muscovite, tourmaline, apatite, zircon. Metavolcanites are fine-grained rocks and show polygonal texture. Fine grained gneisses can be mixed with leptites in the field. However, the sequence of the equidimensional minerals in the microscope along the schistosity is characteristic for leptites. They show an extension to the north and west of Çine. In addition, they extend to the north at north of Bozdoğan and around.

Kavaklıdere Group (Palaeozoic aged cover of Menderes Massif): Meta conglomerate, quartzite, quartz schist, mica schists, marble, metabasic and phyllites are the rocks showing low grade metamorphism characteristics. It is Lower Palaeozoic-Lower Triassic age. There are metachonglomerate rocks which do not show continuity at the base and which laterally pass into quartzites. There are granite, aplite, gneiss, different schist and quartz gravels derived from Çine group in metaconglomerates. They gradually pass into quartzite, quartz schist, garnet schist, mica schist, chlorite, muscovite schist, phyllite and calcschists. It also includes marble and metabasic, metachert bands and lenses. Chloritoid schists contain dark gray and black coloured marble bands and lenses.

In the Kavaklıdere group, it is observed along the top of the quartz schist as well as quartzite. Garnet schists, mica schists, chloritoid-district schists are the uppermost sections of the sequence. The rock is blackish coloured with a distinctive and thin foliation. The most dominant lithology among schists is garnet - micaschists, which are observed in light brown and dirty yellow colours. Marçal group is observed discordant over the Kavaklıdere group which is seen as discordant over the Çine group. All these units are shown as "schist" on the map.

Marçal Group (Mesozoic aged cover of the Menderes Massif): It begins over the Kavaklıdere group unconformably with meta conglomerates and meta clasts. It continues with neritic carbonates. The group is possibly Upper Triassic-Lower "Posen" aged. While the units completely sag with an arch shape whose concave is to the north with their regular sequence, carbonate platform, they partly outcrop in the north irregularly. Southern slope of the Aydın mountains are the places where medium-high-grade metamorphic rocks, which are generally represented with fine grained gneisses with a contact overlapped on the mentioned mesozoic aged marbles, are observed. The relationship of the Büyük Menderes Basin in the north and south with the core and cover of the Menderes Massif differentiates. The sequence observed as regular in the South was reversed due to the reverse faults and overlapping structures in the north. In this section rock groups of different ages, which have different metamorphism characteristics, overlap each other irregularly with horizontal movements. These overlapped structures are not local but rather regional.

The Marçal group begins with a red base conglomerate. The conglomerate passes to thin, medium-thick metasandstone, metasiltstone, yellowish dolomite, and a thick deposit of dolomitic limestone, a thick sequence which has dolomitic limestone over it. Dolomitic limestones are white, gray, dark gray, bluish-coloured, fine-to-medium crystalline, locally stromatolite and irregularly bedded.

Under the dolomite-dolomitic limestones, there are thick and crystallized limestones. They are dirty white, medium-coarse crystalline, medium-thick bedded. It is locally laminal and fractured in parallel with bedding planes. In the lower levels of recrystallized limestones, bauxite and sandpaper lenses are found. The uppermost parts of the Marçal group, which contain plenty of rudist particles, are upper Cretaceous aged. Rudist limestones are locally followed by brecciated limestone levels. Because of the gradual increase in claystone ratios, the mesozoic aged limestones passes to a flysch-like sequence. The sandstone is found at levels composed of shale and crystalline limestone interlayers. The uppermost beddings with nummulite and globorotalia are upper paleocene-lower eocene aged. All these units are shown as marble on the map.

Muğla Group (young sediments on the Menderes Massif): B. Menderes graben divides the Massif into two as North and South. The young tertiary aged units and the uppermost quaternary units alluviums are located in the depression basins and the basins that intersect them. Post-tectonic tertiary units have not been elaborated and shown on the map as neogene. Rocks of the lake-swamp environment (Sekköy Formation) composed of clayed clastic limestones, silt stones and tuff were deposited in depression basins. The rocks of the old alluvial fan environment (Yatağan Formation), which are conglomerate, mudstone and sandstone levels as well as micritic clayed limestone and lacustrine limestone rocks (Miletus Formation) outcrop around Didim. The Neogene sediments of the B. Menderes graben, which are deposited on the active northern edge, are more diffused than the southern edge. Young units are encountered in the form of old terrace sets in the northern part.

Studies on geothermal energy potential are concentrated on the active northern edge. The Neogene units are common in the Bozdoğan basin and Karacasu basin which are perpendicular to the B. Menderes graben. The Karacasu basin has different characteristics than the mentioned basins. Products of the Brackish water (Saumâtre) environment can be observed in this region.

Quaternary Aged Units: The unit shown on the map as "Alluvium" essentially covers Braided river sediment, Meander river sediment, Alluvium fan, alluvial cone and slope washes and also all of the young temporary lake sediments in the Söke plain. They are levels composed of gravel, sand, silt, mud and clay. The depression basin of the B. Menderes graben filled the side base of the sedimentary basin. When the quaternary geology is examined in detail, the levels formed of gravel and conglomerates forming the pleistocene age old terrace sets of the become clear. These units to the north of the depression basin have created a typical morphology.

Magmatic Rocks: In the study area, gabbro and granite, granodiorite, andesite are units shown on the map. The young acid magmatic rocks, which cut the metamorphic units, outcrop in the northeast of Çubukdağ (Buldanmcivar). They are derived from granite and granodiorite. There are also large and small intrusions in the study area. Acid magmatic rocks are seen in both gneisses and metavolcanites. Macroscopically, their outer surfaces are very weathered and in reddish and brownish colour. The unweathered parts are observed as whitish gray. They are hard and non-schistosity rocks.

The gabbros are have small outcrops in different regions. They are all related to tectonic lines. They are arranged in different sizes of stocks along the fault zones. They offer a very hard compact appearance. They have a distinct magmatic texture with white coloured feldspar minerals and dark coloured mafic minerals. The exchange of material between the rimrock and the basic dyke rock has provided a zoned structure to the basic dyke rocks. It is thought that the old dyke rocks with gabbroic composition in the Palaeozoic aged volcanics are metamorphosed. Metagabbros are shown as "gabbro" on our map.

Dilek Peninsula / Selcuk-Tire Imbricated Zone: The rocks outcrops are in tectonic relation with the Menderes Massif. Besides the cover series of the Menderes Massif (schists, marbles), rocks belonging to the ophiolitic community such as metaserpentinite, metadiabase and metagabbro are also observed. Units with large diffusion on the map are schist, serpentinite.

Geological Map of Aydın Province is given in Figure.33.

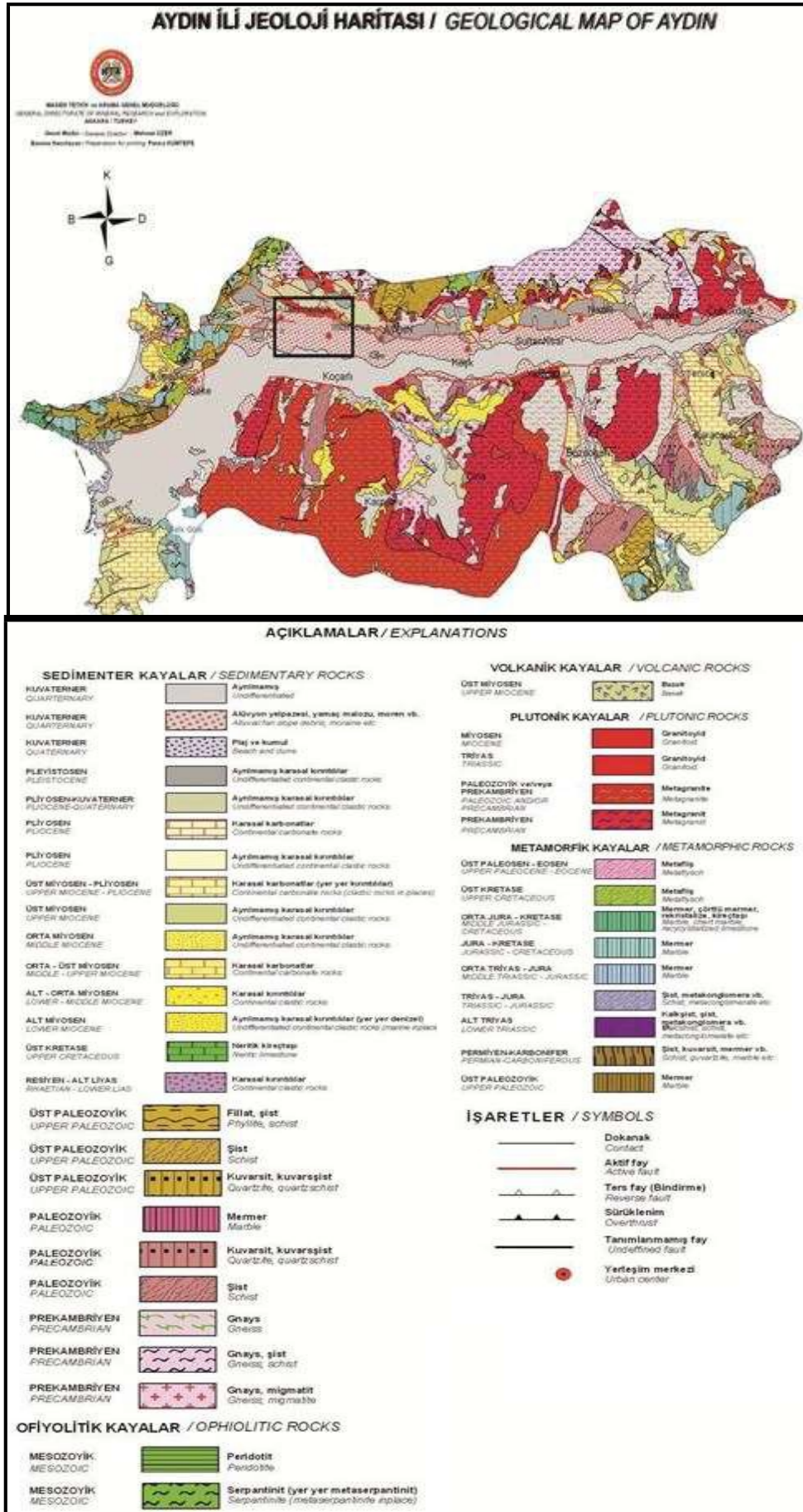


Figure 33. Geological Map of Aydın Province

Metamorphism and Magmatism ⁴

The sequence in general are represented with Palaeozoic aged crystalline series are Neogene aged formations and Quaternary aged alluviums. Palaeozoic aged crystalline series consist of Gneiss series, Micaschist series, Quartzites, Marbles and semi-crystalline limestones. The mesozoic time in the region is a stratigraphic gap. The Neogene has locally a thickness of hundreds of meters reached top of the crystalline schists. Neogene has gravelled, sandy, clayish, marly, sandstone, conglomerate, and locally marly and calcareous levels.

The Quaternary is located in the form of large alluvial cones formed in the mouth of the side streams with large alluvial fields.

Metamorphic rocks

Palaeozoic: In the region, Palaeozoic is represented by metamorphic crystalline schists called Menderes Massif. This series called Menderes Massif is;

Permo-Carboniferous - crystalline limestones intercalated with 200 m schist and quartzite, Devonian - 1000 m marbles,
Silurian - 1000 m various schists and quartzites,
Silurian - Grenachists/Grainschists(?)
(Grenaşistler),
Silurian - Transition from schists to gneiss 20 m,
Silurian - light colored gneisses,
Cambrian and Precambrian - Micaceous Augen-Gneiss
Precambrian - Fine grained Gneisses
Precambrian - Graphite, Garnetiferous Mica Schists,
Precambrian - Gneisses

As can be seen, the Crystalline Rocks are sequenced from bottom to ceiling as gneiss series, micaschist series, quartzites, marbles and crystalline limestones.

Sedimentary Rocks

Neogene: It represents a Neogene lake environment in the region. On the southern and northern slopes of the Menderes Graben, it is directly overlying the crystalline series. According to this, there is a great stratigraphic gap between the crystalline schists, which are considered to be Palaeozoic, and Neogene.

Neogene is composed of sand and gravel, conglomerate sandstone, clay, marl and limestone intercalations. The marls in the region are composed of hard calcareous marn around Söke District. Generally, there are both lateral and vertical transitions and cross stratigraphications between sandy, clayish marly, gravelly and sandstone conglomerated beddings. A young and carbonated platform belonging to Neogene age is located in Didim. In this sequence, carbonated clay stones, marls and cretaceous limestones are found, and the study area is composed of beige coloured thick-bedded hard clayish limestones commonly called "MUKA(?)". This unit is generally stratified, and generally the strata are in the east-west direction and they show slopes of 5-10 degrees.

Structural Geology and Geological History

Hersinian and Alpine Orogenic movements have played a role in the region. All crystalline series belonging to the Menderes Massif are the oldest formations of the region deposited in the Palaeozoic Sea. It is seen that the Lower Gneiss Series Rocks are derived from clays formed in a very deep sea, and the upper micaschist, clayey schist, quartzite and marbles are derived from various clays, limestones and sandstone in a sea whose bottom show periodic movements.

Gneiss and micaschists show too much involvement . Their folding age are Hersinian Orogeny or older movements. No sedimentary formation is observed between the crystalline series and Neogene within the region. According to this, there is a great stratigraphic gap between the crystalline schists, which are considered to be Palaeozoic, and Neogene. Neogene is composed of sand and gravel, conglomerate sandstone, clay, marl and limestone intercalations. These rocks show cross-stratification. Faults encountered in the region are of different ages. The formation of large faults that cut the Neogene strata is related to the Alpine movements which dominate after the Neogene, and the faults in the crystalline series are related to the movements prevailing in this region both before, during and after the Neogene.

The Neogene formations and terrace sets present in the small valley alluvium of the B. Menderes massif show that the Alpine movements are still in progress.

Tectonic and Paleogeography

The boundaries of Aydın Province are located within the Menderes graben. In the studies, it is stated that the North and South boundary faults forming the graben are active. Detailed studies are required on these faults which have potential to lead to an earthquake. Although activities such as floods, landslides, avalanches, etc. are within the projects carried out by our institution, no such project was conducted for Aydın Province.

The oldest unit in the project area and its surroundings is the Palaeozoic aged gneisses of the Menderes Massif. Palaeozoic metamorphics, which are composed of augen-gneiss, gneissic schist, quartzite, mica schist and marble units from bottom to the top, form the base. Plio-quaternary aged terrestrial, lagoon sediments overlie on this metamorphic unit with angular unconformity. Pliocene sediments are the terrestrial and lacustrine sediments, which cover the base, and they consist of conglomerate, sandstone, claystone, limestone, marl and siltstone intercalations. Quaternary slope washes and alluviums are the youngest units of the study area and are overlie the elder units unconformably.

The tension created by the Menderes massif, which emerged in the region after the Pliocene, led to the formation of graben in the east-west direction. The magma intrusions into the massif and grabens caused the formation of the geothermal energy system in the faults limiting the grabens and the fracture zones . Babadag horst, Great Menderes graben, Buldan horst, Gediz graben and Yenice horst, which are arranged from south to north, are the main structures in the region (Şimşek, Ş., 2008, Aydın Germencik Jeotermal Alanı Kaynak Koruma Alanı Etüt Raporu [Aydın Germencik Geothermal Area Resource Preservation Survey Report]).

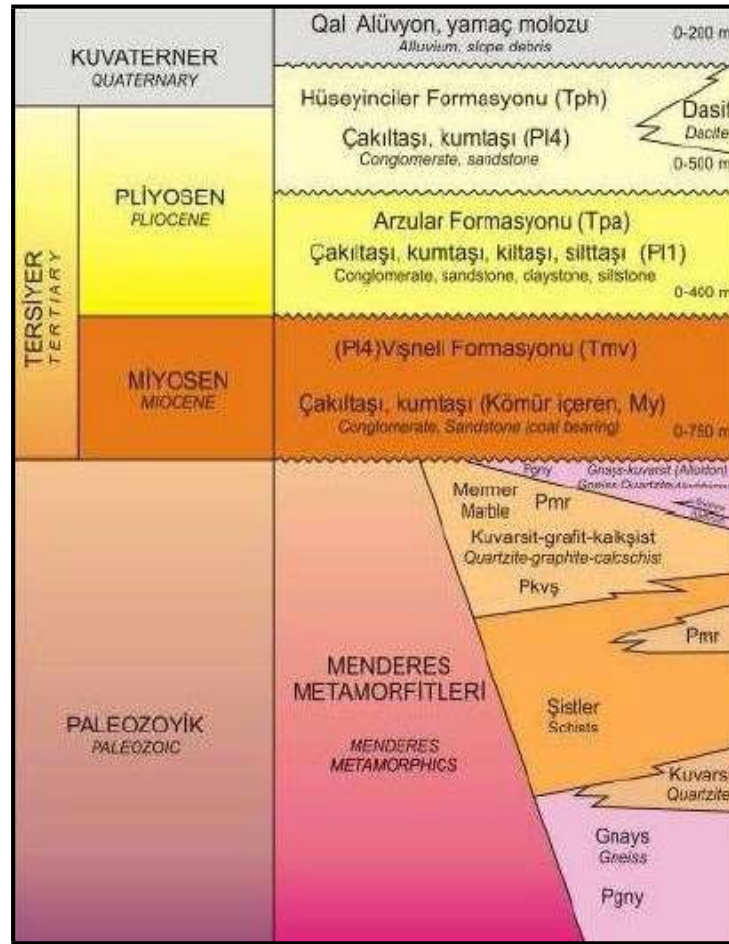


Figure 34. Generalized Stratigraphic Column Section of the Project Area and its Surroundings
Source: Şimşek Ş, 2008

Geology of the Project Area ⁵

The studies on the geology, hydrogeology, hydro geochemistry, isotope geochemistry and geothermal potential of the region have been initiated by the MTA (General Directorate of Mineral Research and Exploration, Ankara) (Çiçekli et al., 1986; Alpar, 1984; Gevrek, 1987; Gülay, 1982; Güner and Yıldırım, 2005; Karamanderesi et al., 1982; Keskin, 1972; Okandan, 1986; Şahin, 2002; Sener, 1984; Simsek, 1981, 1984, 2003).

The area in question is composed of Menderes Massif metamorphic rocks of Palaeozoic age and Miocene, Pliocene and Quaternary aged sedimentary rocks and Middle Miocene aged volcanic rocks. In here, the metamorphic rocks are composed of gneisses, schists, marble, quartzite and various schists. Miocene aged sedimentary rocks are composed of intercalations of red conglomerate, sandstone and claystone and lower levels contain coal. In addition to these, the Lower Pliocene aged conglomerate and sandstone intercalations as sedimentary rocks and the Plio - Quaternary aged coarse gravelled and blocky conglomerate and sandstones are found. These gneisses, which were drifted over the schists and marbles, are called " Allochthonous gneiss".

⁵ Modelling of Hydrothermal Alteration in Geothermal Water Exploration and Production Well of Ömerbeyli Village (Germencik, Aydın) Region, Onur M. Kasımoğlu, İsmail H. Karamanderesi, Nevzat Özgür, Tuğba A. Çalışkan

In the east of Germencik, young Middle Miocene aged volcanic rocks, which are located in the West of Söke and which locally cut Pliocene sediments in places, were determined. These volcanic rocks are composed of basalt and andesite in the west of Söke, and dacite and andesite in the west of Germencik near Ortaklar. The volcanic outcrops in the west of Söke are seen as NE-SW oriented lava dome chain. The dacite outcrops around Çataltepe and Kaynaktaş in the north of Ortaklar cover an area of 3 km². Fresh rock is yellowish, hard, sharp-edged fractured and its joint sets are explicit. The extension is in the direction of Ömerbeyli fault and it is WNW-ESE. These volcanic outcrops, which are seen as acid volcanic rocks and marked on the geological map, have been considered as the evidence that the site shall be positive when making initial evaluations for geothermal energy. It also helped to explain the high temperature gradient in the region (Simsek, 1981).

Great Menderes Continental Rift Zone and the project area regarding the geothermal resource in the region are given in Figure.35.

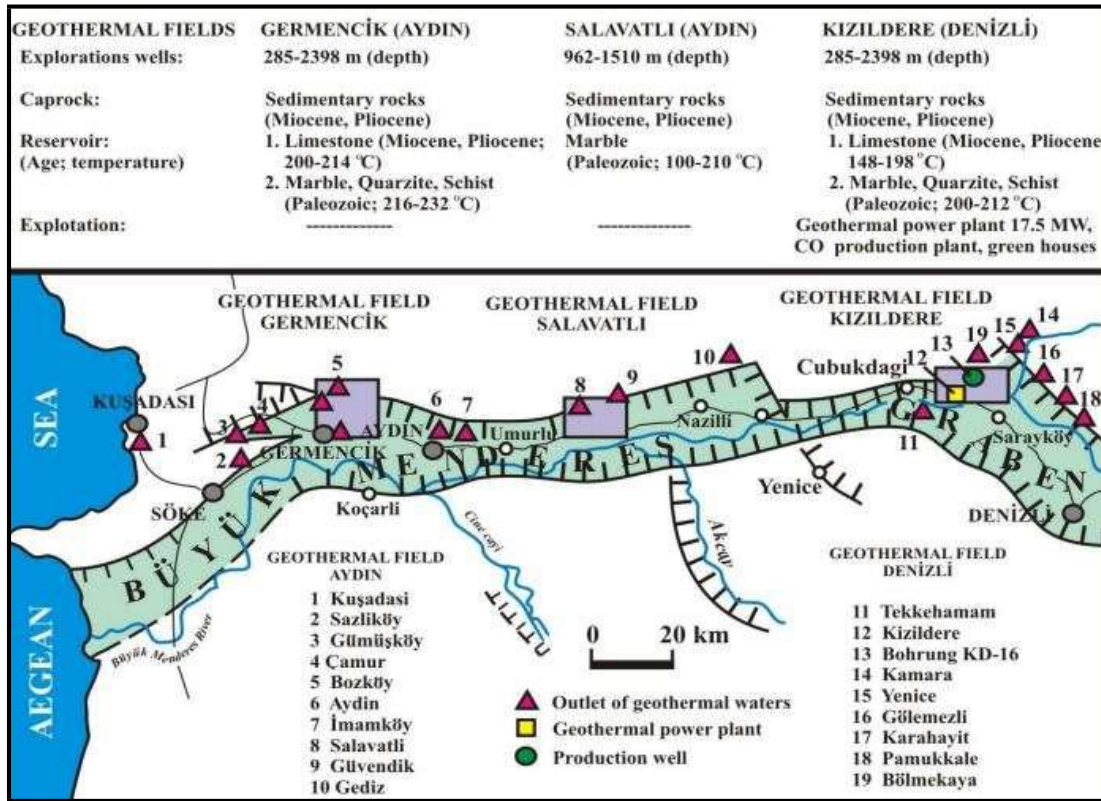


Figure 35. Büyük Menderes Continental Rift Zone and Geothermal Water Locations

J-553 License Area Examinations

According to the Conceptual Geothermal (Hydrothermal) Model created by considering the geological, hydrogeological, geochemical and geophysical data obtained from the field, the hot and mineral waters developed in the underground in Germencik and around formed as a result of warming of meteoric origin waters, which soak into underground from rain and snowfall, due to geothermal gradient are formed because of their rise through the fractures and faults. The development of tectonics in the region and the fact that the fault lines are long, and the faults are normal-slip indicate that the ground gradient may be higher than the other regions. Geothermal waters rising through the faults reaching to the deep, accumulate in the fractured sections of marble, quartzite, gneiss, conglomerates and altered parts. In addition, it is thought that the thermal waters that rise from the deep are accumulating by dilution with the local cold groundwater in the uppermost Plioquaternary and alluvium units but not reaching the surface.

⁶ Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Şakir Şimşek, April, 2012.

The geology map of the project area and its surroundings is given in Figure 36.

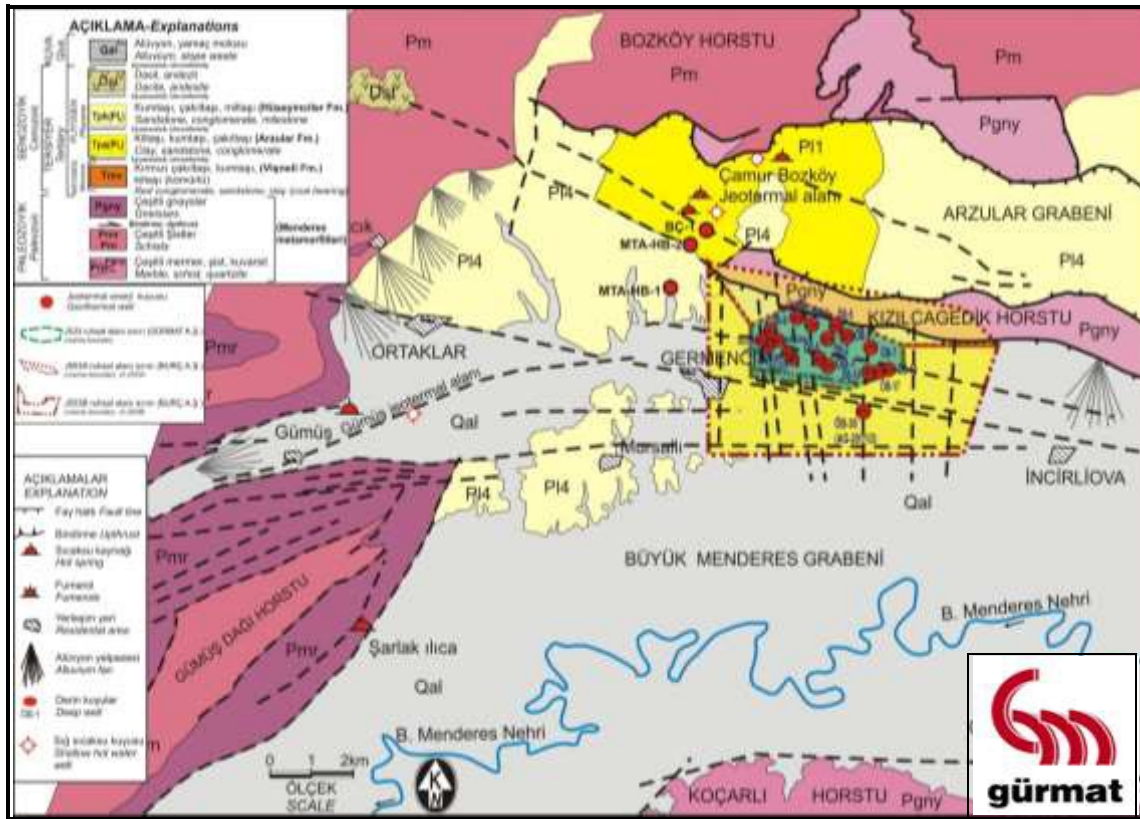


Figure 36. Geology Map of the Project Area and its Surroundings

Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Şakir Şimşek, April, 2012.

Seal rocks in the region are the non-fractured sections of Miocene and Pliocene sediments formed with intercalations of claystone, marl and sandy clay. The mineralization of the hot water in the region is due to the waters filtered through the sedimentary and metamorphic formations, which is widespread in the site, gain salt during circulation in the underground and rise especially because of heat and by means of contact. An estimation has been made for the original temperature in the reservoir in geothermometer applications. Accordingly, a reservoir temperature of 230-260 ° C is expected. In the MTA wells opened in previous years (ÖB-1 to ÖB-9a) a maximum of 232°C and in the ÖB-30 well a maximum of 239.51°C was measured (MTA, 2011b). 18O enrichment due to interaction between water and rock was observed in the isotopic evaluation of the hot and cold-water samples collected from the region. The fact that the hot water in the region has high Cl and low 3H values indicated that they are meteoric waters with deep and long-term underground circulation. In addition, it was calculated by 14C isotope method that the underground circulation age of the geothermal waters (well and spring) is more than 40,000 years (Güner and Yıldırım, 2005). It was calculated that the granitic magma approach (heat source) at a depth of about 9 km is 900 ° C, which provides high local geothermal gradient in the field.

The conceptual geothermal model of the J-553 license area and its surrounding is shown in Figure 37, and the geothermal section is shown in Figure 38.

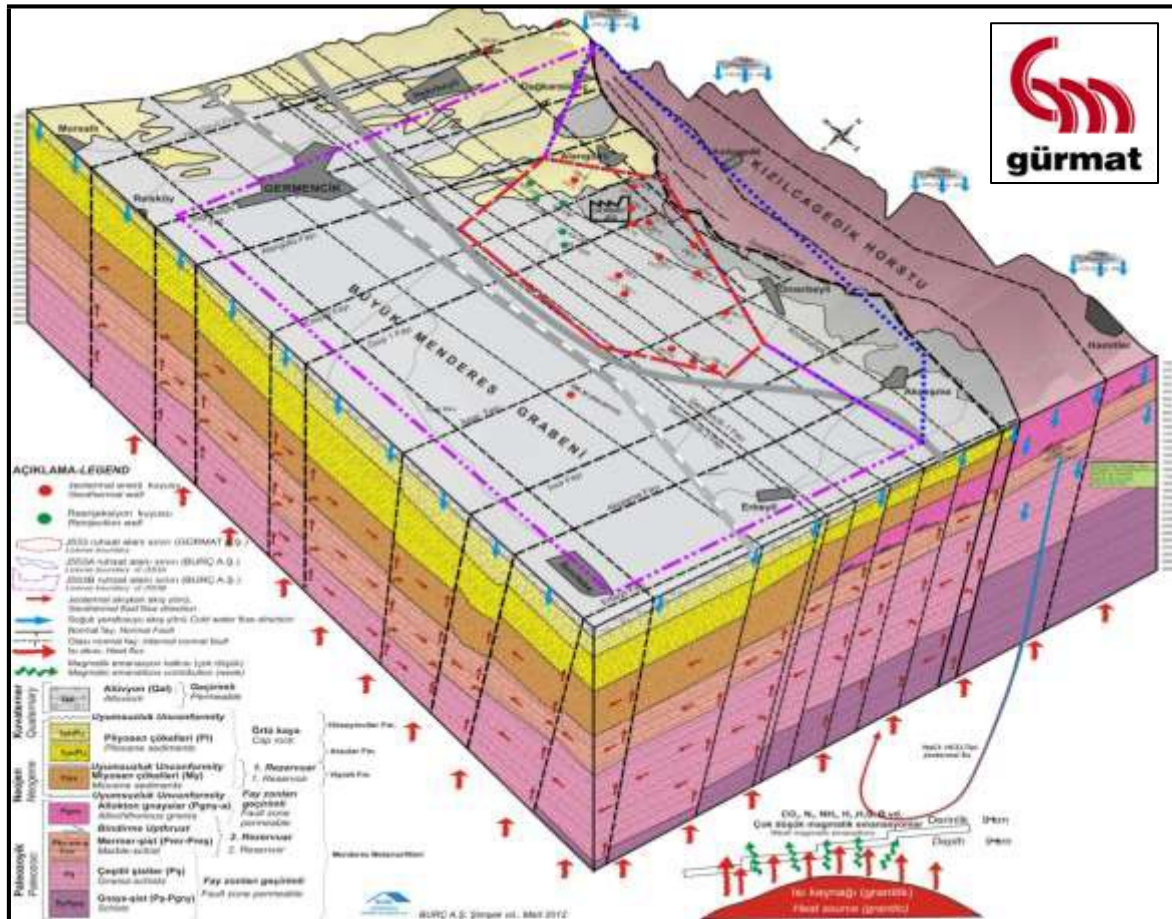


Figure 37. J-553 License Area Conceptual Geothermal Model

Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Şakir Şimşek, April, 2012.

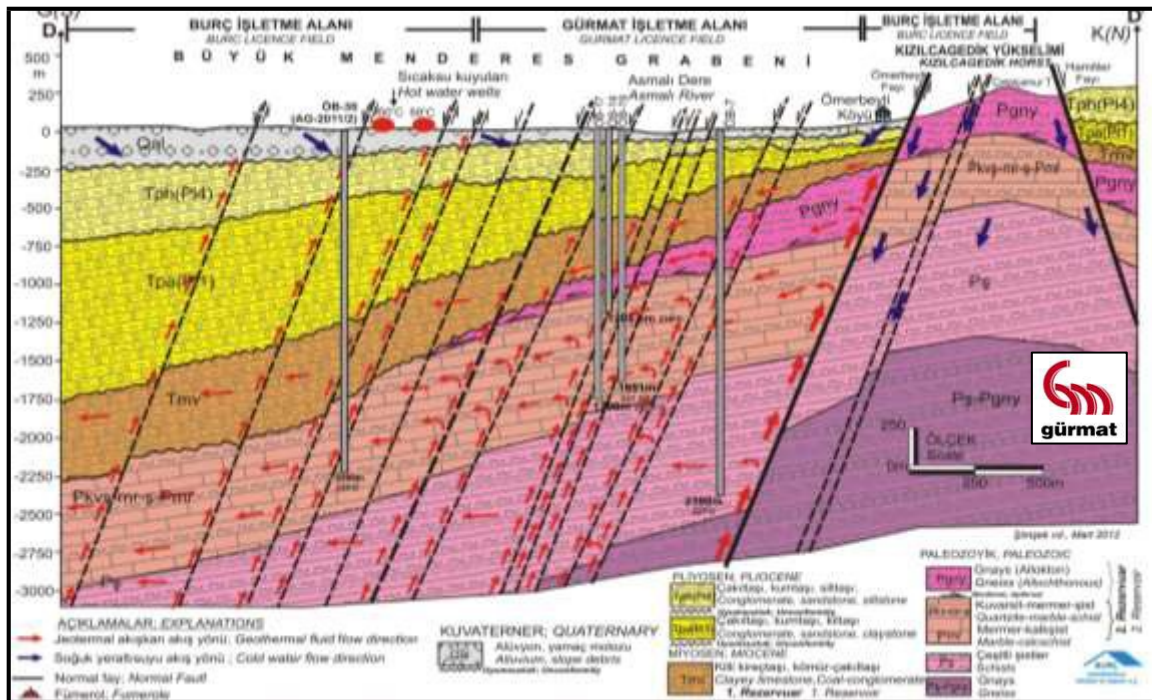


Figure 38. J-553 License Area Conceptual Geothermal Model Section

Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Şakir Şimşek, April, 2012.

The Geological-Geotechnical Survey Report prepared within the scope of the project is provided in Annex-15.

Natural Disaster and Earthquake Status of the Project Area and Its Impact Area

Turkey is located on active tectonic part of the earth's crust, where shallow, frequent and major earthquakes occur, on the Alpine-Himalayan (Mediterranean Area) Earthquake Belt. The main elements of Turkey's tectonic are North Anatolian Fault (NAF), the East Anatolian Fault (EAF) and the Aegean Graben System (EGS). In addition, the Kırıkkale-Erbaa (K-EF) Fault, the Tuz Lake Fault Zone and the Eskişehir Fault Zone may be included in these main elements.

Turkey's General Tectonic Map is given in Figure 39.

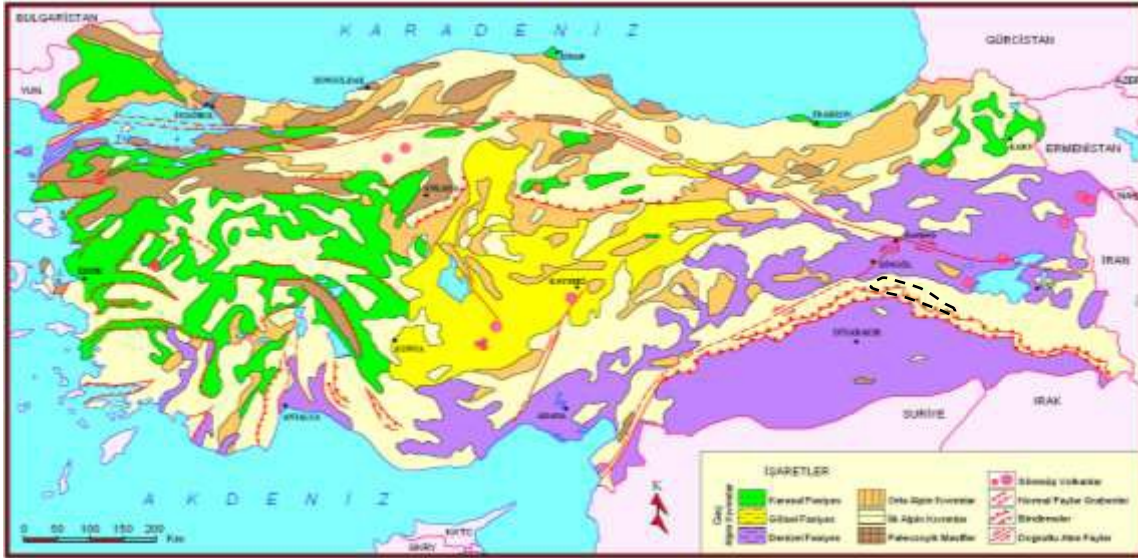


Figure 39. General tectonic map of Turkey

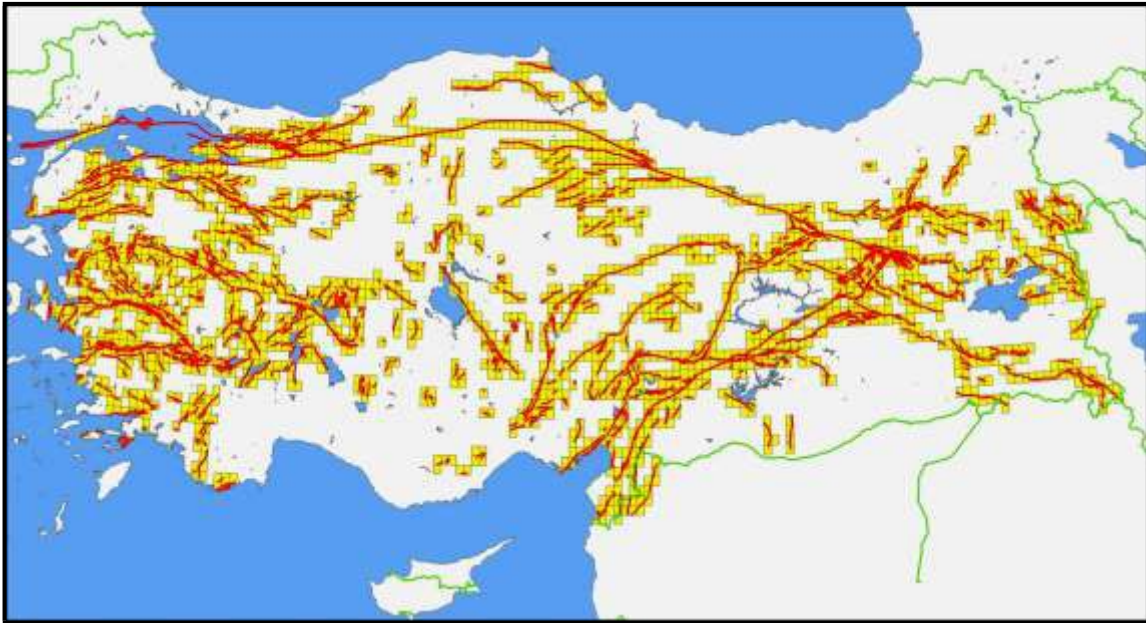


Figure 40. Distribution of Active Faults in Turkey Mainland in 1: 25,000 Scaled Map Sheets

Source: Updated Active Fault Map of Turkey and Their Importance in Earthquake Hazard Determination, MTA General Directorate, Department of Geology Surveys

According to the Map of Seismic Zones in Turkey published by Ministry of Public Works and Settlement in 1996, Aydın Province and its surroundings is on the first-degree seismic zone.

It is known that in the historical periods, the region suffered from earthquakes and many settlements were destroyed.

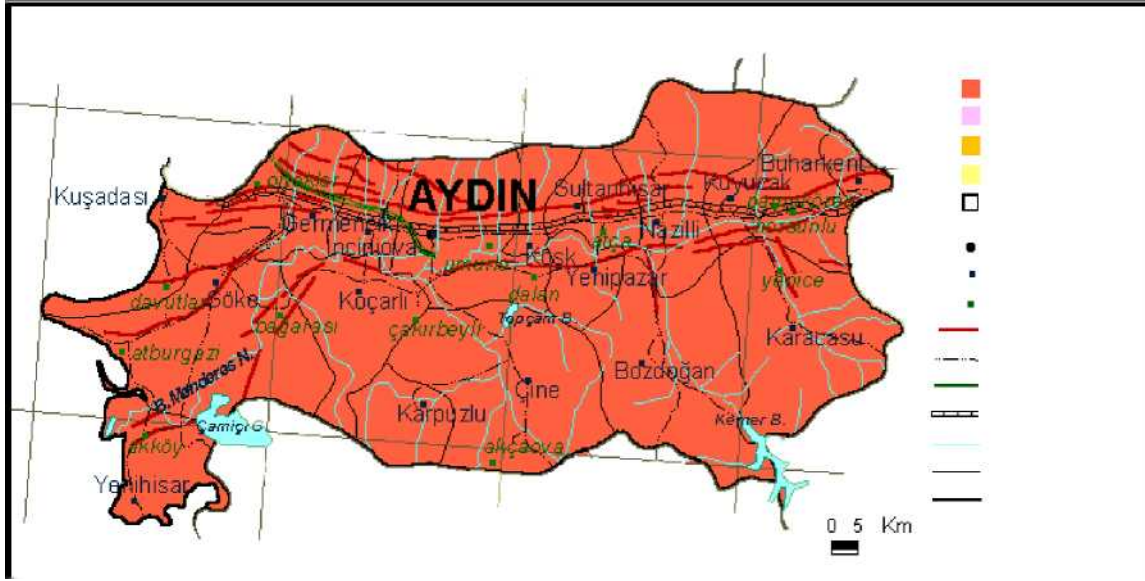


Figure 41. Aydın Seismic Zone Classification

In 1653, a major earthquake occurred in Aydın and due to the earthquake, there has been subsidence in the plain part of the city, the rails were folded because of the fractures cutting the railroad.

The earthquake that occurred in 1653 caused great damages in Nazilli, Kuyucak, Sultanhisar and Köşk districts besides Aydın and there were fractures of land and rising up of groundwater.

In 1899 an external centred earthquake occurred in Nazilli and a great loss of life and property occurred due to the earthquake, fractures reaching to 50 km occurred parallel to the axis of Great Menderes depression.

In the districts and towns outside the city centre, earthquakes at the intensity of 5 in Incirliova, Kuyucak, Buharkent, Pamukören, Nazilli, İsabeyli and Yenipazar and earthquakes at the intensity of 6 in Bozdoğan, Çine, Koçarlı, Sarıkemer, Didim, Güllübahçe, Bağırasa and Sultanhisar were recorded.

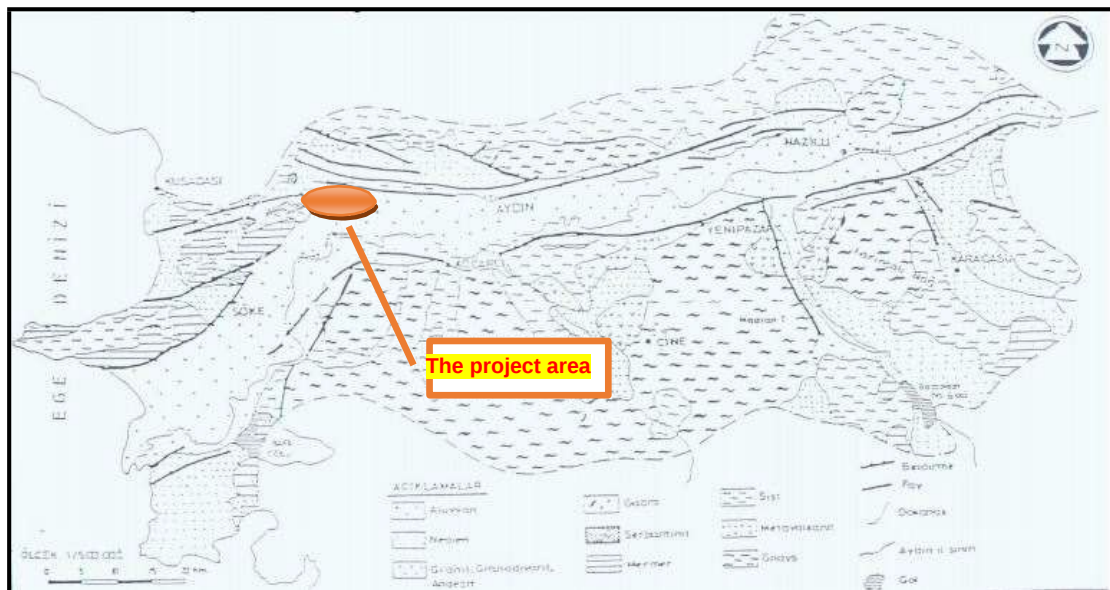


Figure 42. Aydın Province Fault Map

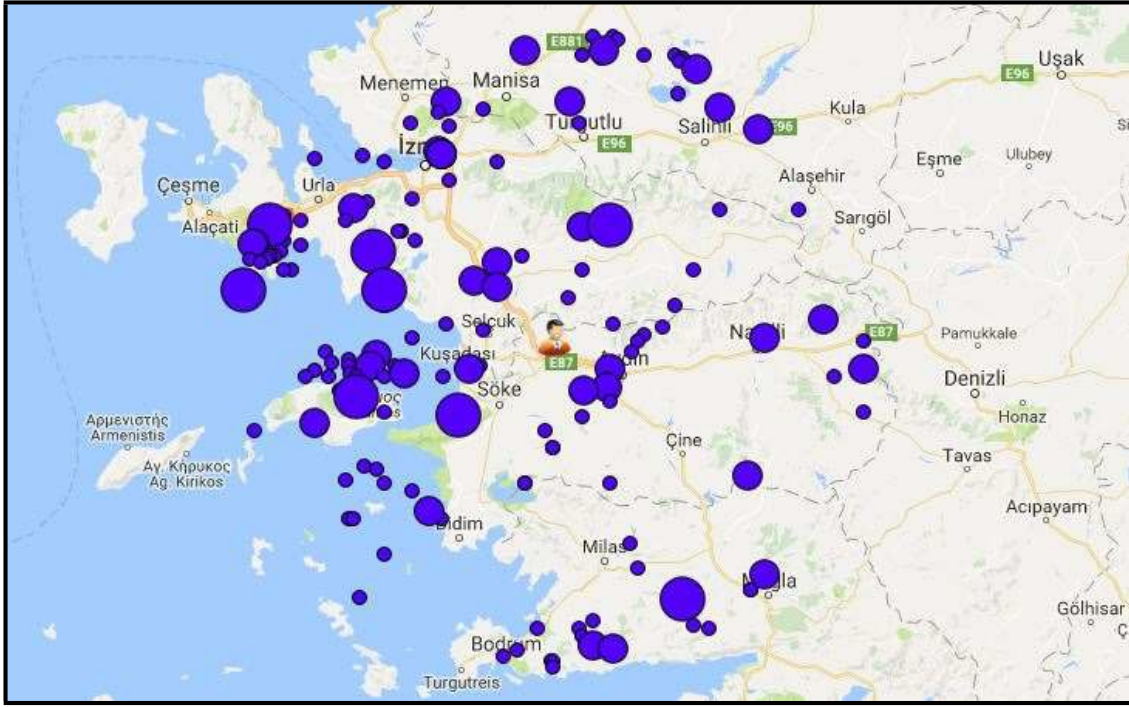


Figure 43. Large Earthquakes in the 100 km Area where the Project Area is Located

Source: Kandilli Observatory, <http://m.koeri.boun.edu.tr/dbs/deprem-tarihcesi.asp>, January 2017.

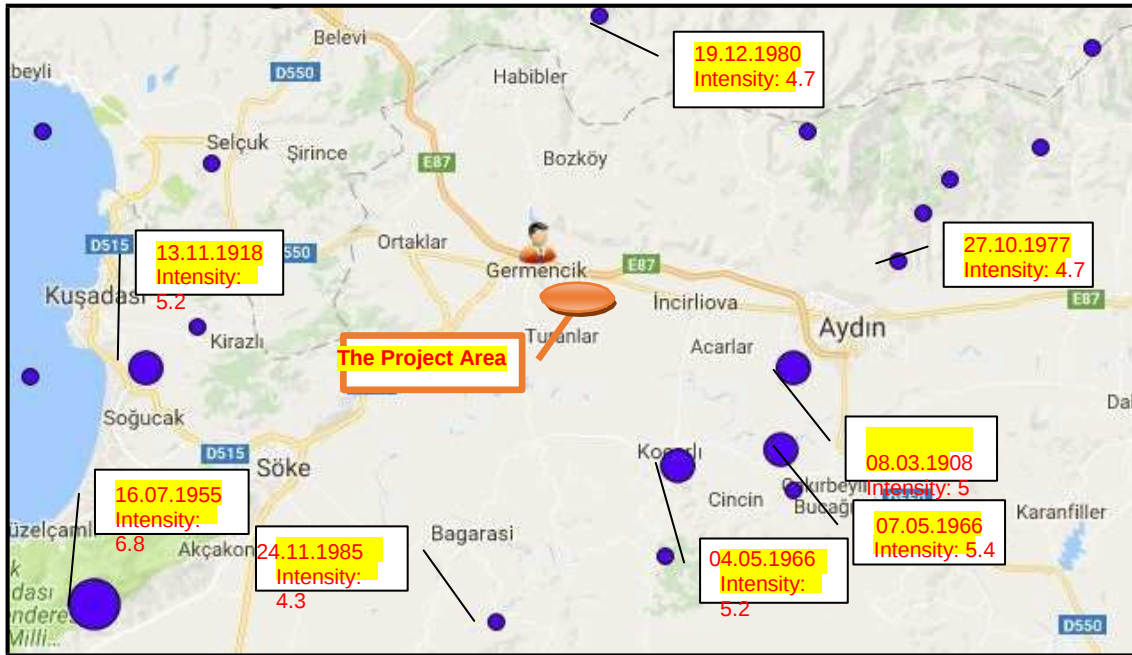


Figure 44. Date and Intensity of the Major Earthquakes in the Project Area

Source: Kandilli Observatory, <http://m.koeri.boun.edu.tr/dbs/deprem-tarihcesi.asp>, January 2017.

All construction works within the scope of the project shall be carried out in accordance with the provisions of the "Regulation For The Structures To Be Built In Seismic Zones" entered into force after being published in the Official Gazette no. 26511 dated 03.05.2007 and the Regulation regarding Amendments to this Regulation published in the Official Gazette numbered 26511 and dated 03.05.2007.

Landslides and Avalanches ⁷

The transportation of 599 houses in Centre-Balıkköy, İmamköy (Gölcük neighbourhood), Musluca, Buharkent-Ericek, Kuyucak-Gencellidere, Kuşadası-Yaylaköy, Germencik-Çamköy- Hıdırbeyli-Kızılcapınar, Söke-Güllübahçe, Sultanhisar-Kabaca due to landslide disaster; 18 houses in Söke-Güneyyaka village due to rock fall disaster was provided by the Ministry of Public Works and Settlement in 2007.

There is no avalanche event in Aydın province due to its climatic characteristics.

Floods⁸

There are many large and small streams within the boundaries of the province of Aydın. B.Menderes River, which has its source in the borders of Afyon Province, and which pours into the Aegean Sea from our provincial borders, has Akçay and Çine tributary branches within the boundaries of Aydın province. Apart from these two side branches, there are many streams whose flow rates vary in summer and winter. Depending on the size of the precipitation basin of these streams and the severity of the precipitation, the flow rate increases from time to time, causing flood effect. These floods sometimes cause flood damages in the residential area, and sometimes in agricultural land. Adıgüzel and Kemer Dams on B. Menderes river, in 2010 Adnan Menderes Dam on Çine Brook, İkizdere Dam on İncirliova İkizdere brook were built by the DSİ (General Directorate Of State Hydraulic Works) and started to operate in order to prevent flood damages. Rehabilitation works for small streams are carried out to the extent of the possibilities of the relevant administration. In addition, according to 21st Regional Directorate of DSİ, 49.4% of the recorded floods between 1945-1994 occurred in November-December-January period, 30.3% occurred in June-July-August period and nearly all of those floods in the first period are floods occurred in B. Menderes and its tributary branches, its impact area is between Denizli Province Sarayköy-Söke, the floods of the second period are those seen in local dry creeks and they are intensified around Denizli-Acıpayam; moreover; the flood events are majorly under control with the help of flood prevention works carried out by the Relevant Institution as well as storage facilities founded on the streams, however the problem still continues in Mugla centre, Söke District centre, Denizli-Serinhisar etc. areas and it is stated that one of the most important reason of this is inadequate infrastructure, improper settlement and distortion in the climate and ecological balance in the recent years.

After the heavy rains in Aydın province on 10 December 2010, there has been floods and deluges in Koçarlı district centre and Yeniköy Town within the boundaries of the district, Büyükdere, Cincin, Çakmar, Gündüzlü, Kasaplar, Sobuca, Yağhanlı, Haydarlı and Boydere villages, Bağarası Town of Söke District, Avcılar and Çalışlı villages, 412 households were affected by this disaster, 3 houses were demolished and 2 house had Heavy, 6 had Medium and 16 had Little damages according to the final damage assessment carried out by Governorship Damage Assessment Committee for Gündüzlü Village which was subject to Affecting The Life of General Public decision taken by Prime Ministry Disaster and Emergency Management Presidency.

⁷Aydın Province Environmental Status Report for 2011
⁸Aydın Province Environmental Status Report for 2011

Forest and Grassland Fires 9

Before mentioning the forest fires, brief information about the forest vegetation of Aydın shall be given; Vegetation status in these areas is as in the following. It consists of Black pine, Brutia Pine, Stone Pine, Maritime Pine, Oak types, Linden, Chestnut, Sycamore, Maple, Ash, Poplar and Laurier, Sandalwood, Turpentine, Gumwood, Locust, Wild Pear, Blackberry, Oleander, which we call as Maquis vegetation. Generally, criteria such as relative humidity, temperature, tree species and altitude are effective in Forest Fires. Forest fires are classified as surface fire, trunk fire and crown fire. The most harmful of these fire types are those in the form of trunk and crown fire. The reasons for the fire are generally caused by human factors such as shepherd's fire, stubble burning, cigarette stub and carelessness. With the forest fires resulting from different reasons, the soil structure deteriorates, and erosion occurs. With the deterioration of the soil structure, the permeability of the soil decreases, the soil is transported with water and erosion occurs. Soil structure will be maintained, and groundwater shall be fed by preventing forest fires. Prevention of transportation of the soil and maintaining the quality of the soil shall be ensured by increasing afforestation of empty and uncultivated lands and especially high inclined areas. Mediterranean climate and vegetation cover, which is also seen in the province of Aydın, pave the way for forest fires in the days with low relative humidity and high wind intensity. On the days when the air temperature is above normal, risky days for fire hazard occur in Aydın province which is in a first-degree vulnerable zone. Studies regarding forest fires and their prevention in Aydın province by Aydın Directorate of Forestry is carried out in two main groups in the form of preparations before the fire season and during the fire season.

According to information received from the Forestry Directorate, continuous monitoring and communication is made from the 19 watchtowers by the staff and watchtowers working for controlling and fighting (possible) forest fires due to any reason within the provincial borders, for the aim of immediately detecting the forest fires and the public is warned against forest fires in critical weather conditions. Due to the touristic nature of the province, social pressure on forests is increased throughout the season and the risk of forest fire that may arise from human factor increases. In order to reduce the risk arising from social pressure, green belt and new parks are opened. During the fire season, motorised fire extinguishing crews are assigned continuously. In addition, our farmers can cause fire from time to time during land and edge cleaning works. These fires first emerge in the agricultural land and then may turn into forest fires. The reasons of forest fires in Aydın province can be defined as forest fire due to carelessness and neglect and forest fire caused by fires in agricultural land and other reasons. A fire disaster occurred on 19.04.1981 in Karacaören village of Karacasu district in Aydın province. As a result of this disaster, new houses have been built for 31 disaster victims whose houses became useless.

9Aydın Province Environmental Status Report for 2011

II.2.3. Hydrogeological characteristics (Underground Water Levels, All Kinds Of Existing Caisson, Deep, Artesian Etc. Well Safe Drawing Value; Physical, Chemical, Bacteriological Properties Of Water, Existing And Planned Usage Of The Underground Water, Flowrates, Distance To The Project Area)

There are metamorphic rocks of the Menderes Massif in the Germencik District of Aydın. The marbles inside the massif form the main reservoir rock. The marbles have local melting cavities and have a fractured structure due to tectonic effects. Because of these properties, they have high porosity and permeability. Micaschists beneath and above the marble have low porosity and permeability. Schists are seal rocks due to these features. Gneisses can show high porosity and permeability due to both faulting and close relationship with marbles in the exploitation area (Karamandersi, 1989). The loose, sandy, gravelly parts of the Neogene sediments on the base units have high porosity and permeability and have a reservoir characteristic. The hardened parts of these units and the clayish levels are the seal rock.

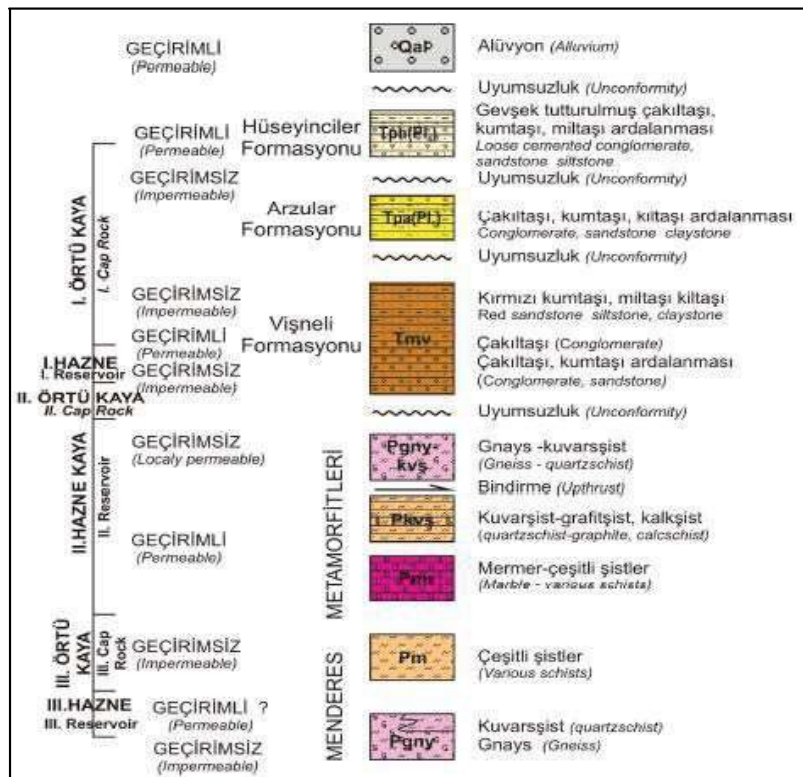


Figure 45. Germencik Region Hydrogeology Units

Underground Water Levels ¹⁰

In the Aydın-Söke Sub-basin and Nazilli-Kuyucak sub-basins, which are within the borders of Aydın province, the groundwater level at the upstream part is 65 m while it reaches 5 m after Söke. Although there is nearly 3 m of reduction in groundwater levels, this reduction can be interpreted as the effect of the drainage system of the irrigation project.

¹⁰Aydın Province Environmental Status Report for 2015

The recharge on the Çine plain is from Karpuzlu region and the mountainous region to the east of the Çine settlement. While groundwater levels vary between 100 - 50 m in the plain, the general groundwater and surface water flow direction is from south to north and leaves the basin around elevation of 30 m in the Çakırbeyli area, which is the exit point of the Çine-Yatağan basin boundary, discharge to the Aydın Söke sub-basin. In the upper elevations of Bozdoğan, while the groundwater level is 310 m, the hydraulic load value at the exit point of the Kale - Tavas sub-basin reaches up to 60 m. When the groundwater levels were examined by years, there were no serious reductions in these sections. In the region, Palaeozoic aged marbles, sandy-gravelly levels of Tertiary aged units and sandy gravelly levels of Quaternary aged alluvium have aquifer quality.

Hydrogeology of the Project Area

When the geology of the planned project is examined, it is seen that the sedimentary units have spread widely. These units have varying levels of permeability according to retention level and grain size. It was observed that the permeability level of the clay silt-sized grains was less than 10-5 cm/s. These units with varying permeability values according to the retention level are generally classified as low permeable or impermeable. With the increase in grain size of the sedimentary units, the permeability value is increased despite the decrease in the porosity value.

The presence of alluvium in the project area, conglomerate, sandstone-mudstone-limestone intercalated units generally have a permeability value greater than 10-5 cm/s and semi-permeable, permeable and very permeable. As an example of the units classified as impermeable, it is possible to point at the Eugene Gneiss-Metagranitoid geological unit.

The area where the planned project site is located completely consists of alluvial and alluvial fan and its porosity and permeability value is high. According to this information, it can be said that the project area is in a permeable - very permeable hydrogeological assessment. Hydrographical map of the project area is given in Figure.46 and hydrogeological map is shown in Figure.47.

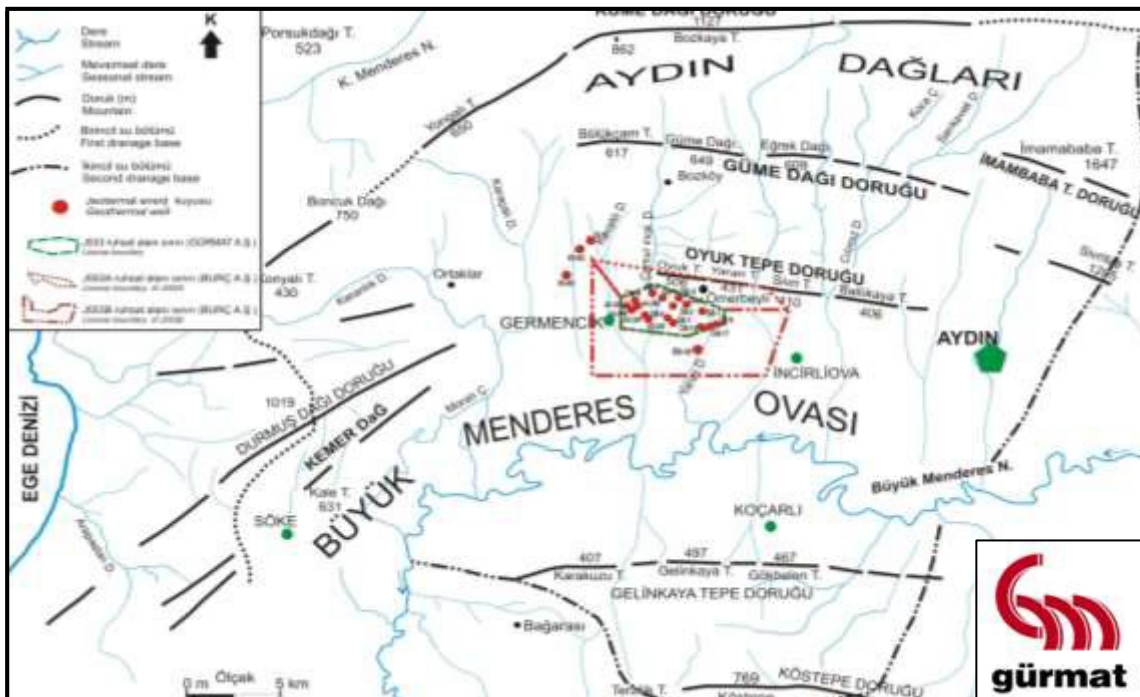


Figure 46. Hydrographical Map of J-553 License Site

Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Sakir Simsek, April, 2012.

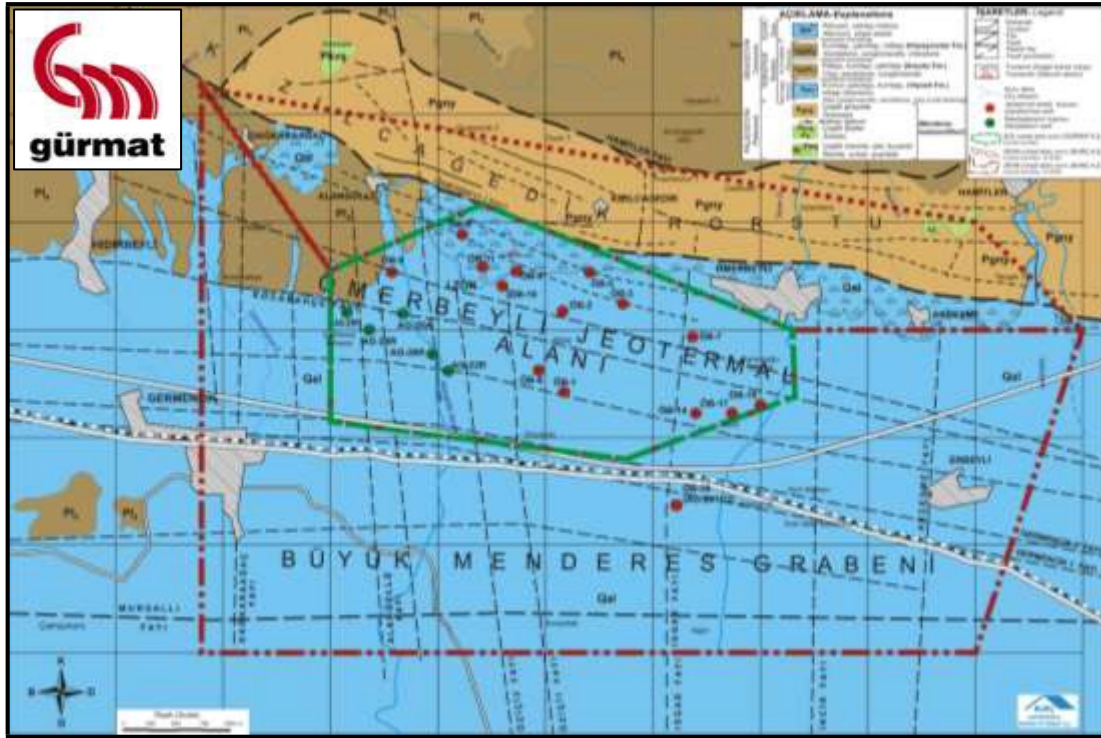


Figure 47. Hydrogeological Map of J-553 License Area

Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Şakir Şimşek, April, 2012.

Mineral Water Resources

Warm and cold mineral water resources with plenty of CO₂ output are seen in Arzular Graben zones, where allochthonous gneisses outcrop, and in the fault zones where ferrous hydrothermal alterations develop. However, their flow rate is small.

Shallow Hot Springs

It is noteworthy that it was observed there were hot springs in shallow depths of 10-150 m in the region drilled during the initial surveys (Şimşek et al., 1980). It was detected that there is hot water at 50 ° C in Ömerbeyli village and 50- 59 ° C in 4 wells on the south side of İzmir-Aydın highway.

Groundwater

There is abundant groundwater in the wide alluvial plain where the Büyük Menderes River is located. There is also free underground water in stream beds reaching to this plain and in alluvial fans reaching to plains. Cold water is operated on several levels in the alluvial plain of Büyük Menderes which has a large alluvial area. The groundwater quality is deteriorated due to the geothermal fluid interfering with groundwater along the Ömerbeyli fault, the groundwater cannot be used as drinking water along the area from the south of Ömerbeyli and Hıdırbeyli to the main road. This situation is stated in DSİ reports before drilling (DSİ, 1975).

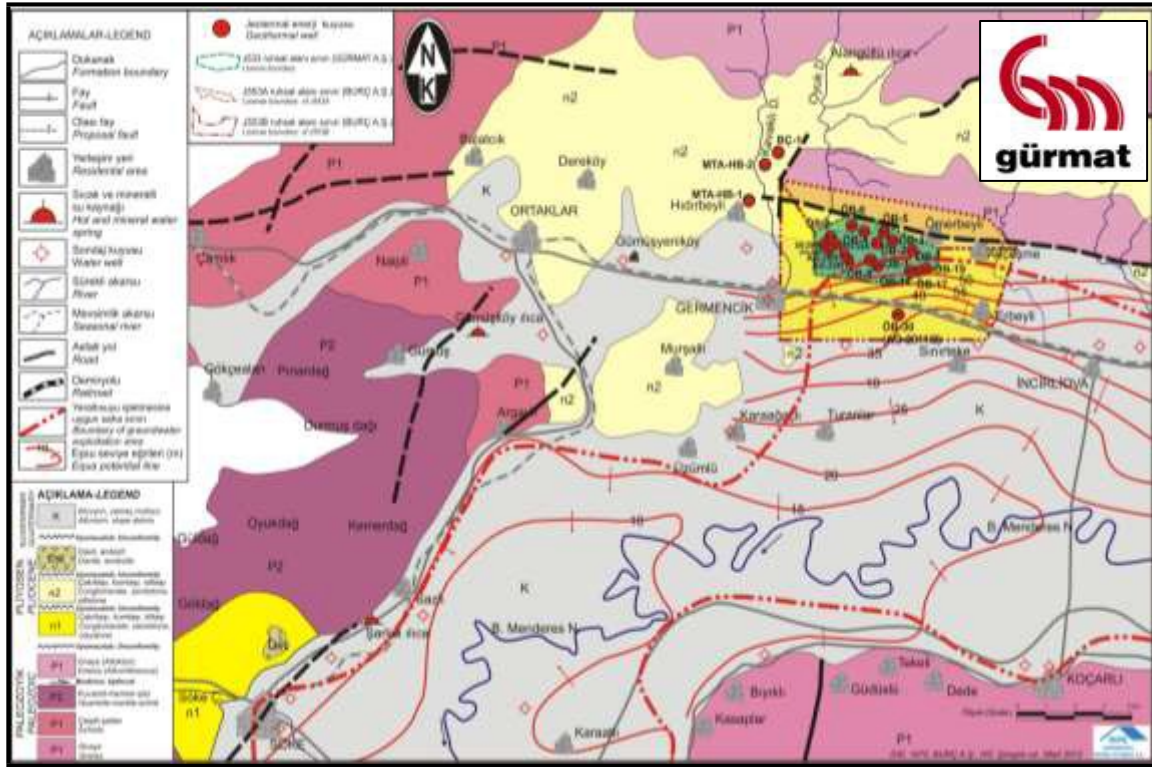


Figure 48. Groundwater in J-553 License Area

Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reinjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Şakir Şimşek, April, 2012.

Resources

There is low flow rate ($Q = 0.1-3 \text{ l/s}$) cold water and hot springs in the map area.

Cold Water Springs

Generally, there are cold water springs at low flow rate in horsts, in the forested area and around the main faults at the edge of the horst. Cold spring waters from quartzite, marble and gneisses are transported to settlements in the plains for usage as drinking water.

Hot Water Springs

In Germencik region, there are many hot water springs with temperatures ranging from $36-92^\circ \text{C}$. These springs, which are in the north of Kizilcagedik horst, are mainly Çamur hot spring and Bozköy springs.

Çamur Springs

There are many hot springs at 6 km north of Germencik district along the Çamurılıca Stream reaching at 92°C . These hot waters, which have nearly 1.5 l/s flow rate, have $\text{Na} > \text{Ca} > \text{K}$ quality by cations and $\text{Cl} > \text{HCO}_3 > \text{SO}_4$ quality by anions.

Bozkoy Thermal Springs

It is at 3 km northeast of the Çamur spring. Its temperature is 62°C and its flow rate is 2 l/s . It is distinct with its sulphurous nature. Travertines are developed around the spring. They are classified as $\text{Na} > \text{Ca} > \text{K}$ by cations and $\text{HCO}_3 > \text{Cl} > \text{SO}_4$ by anions.

Gümüşköy Springs

It is on the northern main fault of Gümüş Depression and at 2.5 km SW of Ortaklar sub-district. Its temperature is 42°C and its flow rate is very low due to the shallow wells. In this area, hot water at a temperature of 33°C was found in the well drilled by DSI.

Natural Steam Outlet (fumerole)

A natural steam outlet at a temperature of 101 ° C was found in the Aktaş area of Ömerbeyli village at 3 km north east of Germencik district. Fluids from the active fault zone at 500m south of the Ömerbeyli fault, this zone appears as a wet zone that does not flow from the surface in summer and winter. Steam outlet is apparent in winter. Young hydrothermal alterations developed at the side of the fumerole.

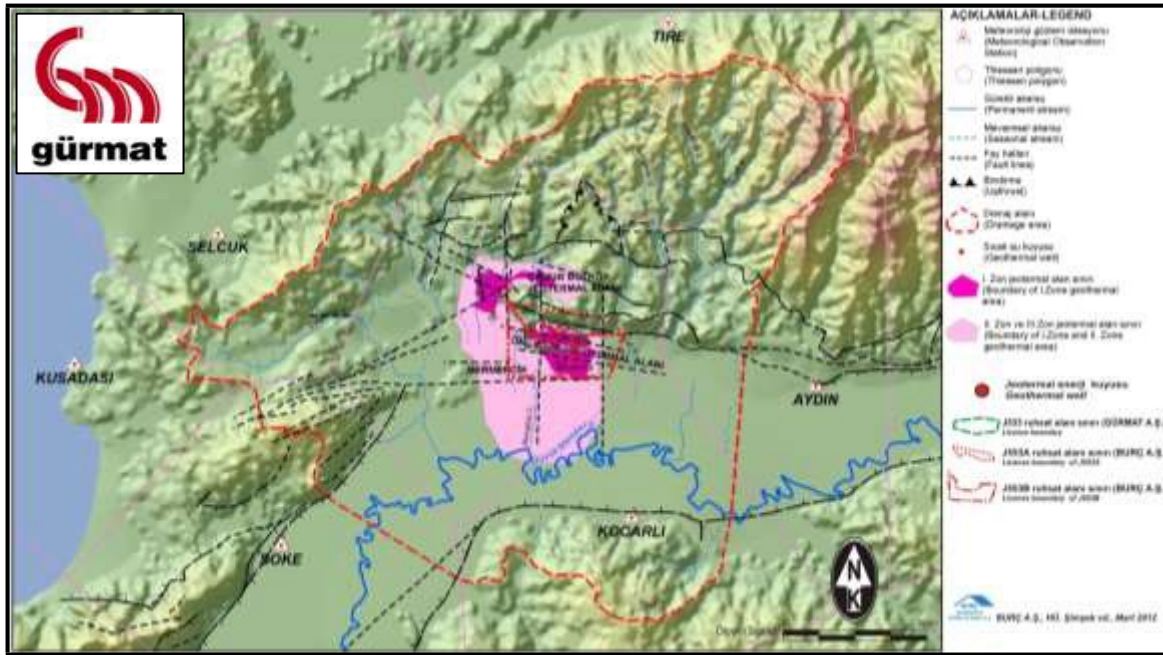


Figure 49. J-553 License Site Feeding Area

Source: Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], Prof.Dr. Dr. Şakir Şimşek, April, 2012.

II.2.4. Hydrological Characteristics (Physical, Chemical, Bacteriological and Ecological Properties of Lake, Stream and Other Wetlands Among Surface Water Resources, Flow Rate and Seasonal Changes of Rivers, Floods, Oligotrophic, Mesotrophic, Eutrophic, Dystrophic Classification of Drainage Basin, Sedimentation, Drainage, Coastal Ecosystems of All Water Resources)

Project site is located within the Büyük Menderes basin that is one of the separated water basins throughout Turkey.

The topographic view of the Büyük Menderes Basin is provided in Figure.50.

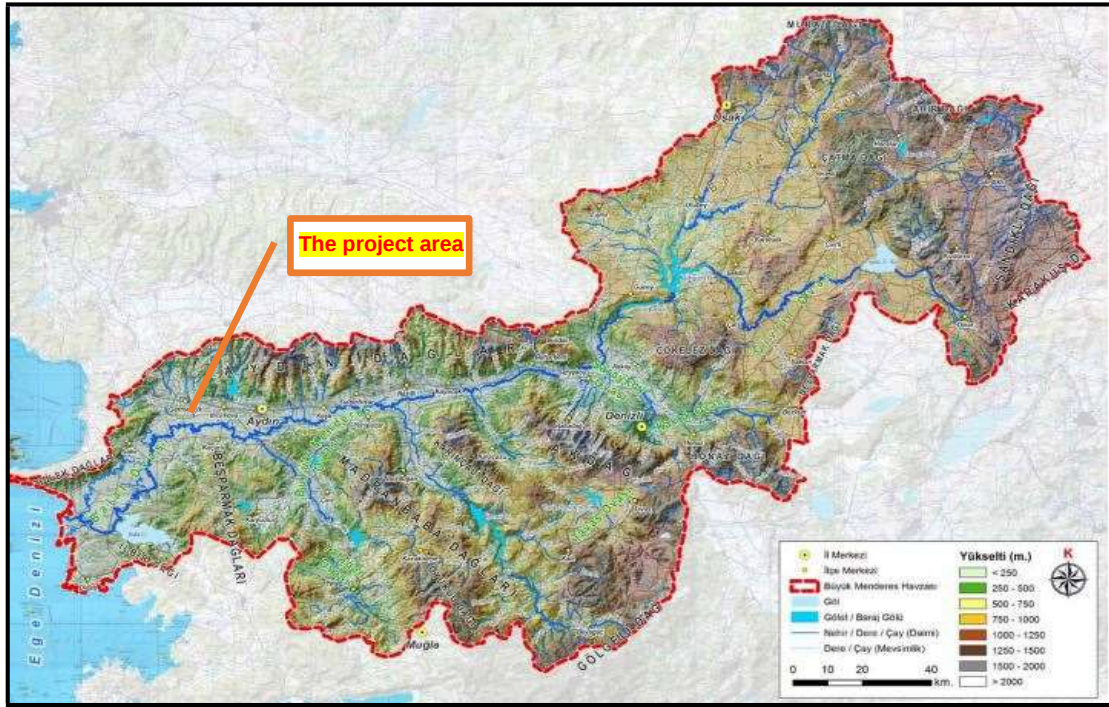


Figure 50. Topographic Map of Büyük Menderes Basin

The Büyük Menderes River, which gives its name to the basin, is 584 km long and is the longest river in the Aegean Region. It originates from the plateaus between Sandıklı and Dinar (Afyon) in western Turkey and the sources leaked from near Çivril and Honaz (Denizli). It is fed by the waters that fill the Işıklı lake. It incorporates the Banaz brook water from Uşak and Çine Brook water from Muğla and it gives its name to a basin of 2.600.967 ha and it flows in Aegean Sea. The river is fed by a large number of tributary creeks. The important branches of the river are Çine, Akçay, Emir, Banaz, Kufi, Dandalaz and Madran Brooks. The important standing waters in the basin are the Çapalı Lake near Dinar, Işıklı Lake in the south of Çivril, Bafa Lake in the river mouth and the Kemer Dam artificial lake on Akçay. There are also many alluvial-set lakes in the river mouth which the most important is Karine Lake.



Figure 51. Lakes and Rivers in Büyük Menderes Basin

Büyük Menderes River is a stream consisting of 39 main branches. There are 10 natural and artificial reservoirs (dam-lake-pond) at various points on the river and 11 new reservoirs are planned. There are 4 main groundwater bodies in the catchment area. Previous studies have shown that Işıklı, Bafa, Karakuyu lakes and Dokuzsele, Banaz, Çürüksu, Karacasu, Akçay, Çine and Büyük Menderes Rivers should be treated as heavily modified water bodies.

When we consider the use of water throughout the basin, we can say that water use for agricultural irrigation, urban (drinking) water use, industrial water use, transportation, geothermal sources and thermal facilities is concentrated in the upper and middle parts of the basin. Geothermal resources are used for tourism purposes in Afyon Sandıklı, Denizli Sarayköy, Pamukkale and Karahayit districts and in the vicinity of Aydın Buharkent and Germencik districts. Water use for Hydroelectric power plants also in question. Energy generation is carried out in Kemer HEPP located on Akçay and Cindere HEPP located on the main branch of Büyük Menderes.

In addition, 4 hydroelectric power plants were planned on Gökpınar and Banaz rivers. Moreover, uses for energy generation are in Denizli Sarayköy and Aydın Germencik and Salavatlı districts. In the Büyük Menderes Basin, water is needed more for agricultural irrigation.

While 38% of irrigation needs is met by groundwater in Turkey, irrigation water is provided from streams in Büyük Menderes Basin. In the basin, the most widely used irrigation source following the rivers is the dams. While 16% of the lands of Turkey is watered by dams, it is 30% in Büyük Menderes.

The need for agricultural irrigation need is followed by industrial use and drinking water need.

The İkizdere Dam in the basin is currently used for the purpose of providing drinking water for the province of Aydın, and the Gökpınar pond in Denizli Province and the Karacasu pond located in Aydın Province also have the potential to be used for drinking water. (Büyük Menderes HKEP, 2010).

In the Büyük Menderes Basin, the use of groundwater for both drinking water supply and irrigation is quite common. Groundwater resources within the basin can be defined as 4 main water bodies. The two largest water bodies, Aydın-Denizli and Uşak-Banaz-Sivas, are directly connected to the Büyük Menderes River. The other two water bodies, Tavas-Kale and Muğla-Yatağan resources are indirectly connected to the Büyük Menderes River mouth (Büyük Menderes HKEP, 2010).

Since it is the only province that has borders with the sea in the Büyük Menderes Basin, all sea discharges are within the boundaries of this province. Treated water of Bozdoğan General Waste Water Treatment Plant in this region, the wastewater treatment plant of the District Municipality of Didim and Akbük Wastewater Treatment Plant belonging to the same municipality are discharged into the sea.

In addition, the coastal areas are overbuilt for holiday purposes (hotels, motels, resorts and holiday villages, etc.). Site and hotels have portable treatments and they generally use treated water for garden and environment irrigation (Büyük Menderes HKEP, 2010).

Rivers ¹¹

The largest stream within the boundaries of Aydın Province is the Büyük Menderes River, which flows from East to West and flows into the Aegean Sea from Söke West. Some of the creeks connecting to this river are Alangüllü Brook, Kavaklı Creek, Oyuk Creek, Yalkı Creek and Cılimbiz Creek.

¹¹Aydın Province Environmental Status Report for 2015

Büyük Menderes

Büyük Menderes River is 584 km long and is the longest stream in the Aegean Region. It originates from the plateaus between Sandıklı and Dinar (Afyon) in western Turkey and the sources leaked from near Çivril and Honaz (Denizli). It is fed by the waters that fill the Işıklı lake. It incorporates the Banaz brook water from Uşak and Çine Brook water from Muğla and it gives its name to a basin of 24.976 km² and it flows in Aegean Sea. Its length in the territory of the province is 283 km.

The river formed an alluvial plain of 320 km² by carrying 13 million m³ of alluvium every year. Each year, 200 ha of agricultural land is covered with alluvium and every year 2,000 ha of land is flooded. The river is fed by a large number of tributary streams.

Dandalaz Brook

It is the result of the waters collected in the south-east of Karacasu. In the beginning, it was called Geyre Brook. Işıklar creek and Akyar creek, emerged in the piedmont of Babadağ, join from the right. It flows down to a plain rapidly on a pebbly and rocky bed and joins to B. Menderes near Kuyucak.

Akcay

It emerges in the mountains at the north-east of Muğla. It joins Yenidere flowing from the slopes facing Tavas plain. It begins to flow rapidly in narrow and deep valleys. Near the Bozdoğan, before reaching to the plain level, Kemer Dam is built on it. It crosses the valley between Karıncalıdağ and Madran by flowing towards north-west. It reaches to B. Menderes near Yenipazar.

Çine Brook

It is formed by joining of the waters flowing from a large spring called Pınarbaşı near Bozüyük village to the Bencik and Kamış creeks. It incorporates Sağan, Gökçay and Madran creeks. It flows down to the plain in Eskiçine. After irrigating the plain of Çine, it joins to the Karpuzlu Brook. It reaches B. Menderes near Çiftlikburnu.

Other Small Rivers

There are many creeks joining to B. Menderes within the boundaries of Aydın. From the right side; Feslek, Kestel, Malgaç, Köşk, Musluca, İmamköy Creek. Those joining from Aydın; Tabakhane Creek between Aydın-Germencik; Karagöz, Yalkı, İkizdere and Alangüllü Creeks. Those joining from left side; Kocadere, Dalama creeks. After the Çine brook; Çakırbeyli, Çakmar, Koçarlı, Sarıçay creeks.

Table 27. Rivers in Aydın Province

River Name	Total Length (km)	Length in Province Borders (km)	Min Flow Rate (m ³ /s)	Max Flow Rate (m ³ /s)	Average Flow Rate	The River it is a Branch of	Purpose of use
Büyük Menderes	584	293	1.000	700.0	80.55		
Çine Brook	359	143.9	0.000	625.0	10.70	Büyük Menderes	Irrigation, Energy and Flood Protection
Akçay	158	69.8	0.004	975.0	20,10	Büyük Menderes	Irrigation, Energy and Flood
Köşk Creek		23.1	0.000	170.0	1.070	Büyük Menderes	Irrigation
İkizdere		21.5	0.000	450.0	2.130	Büyük Menderes	Drinking Water Supply
Dandalaz Brook		44.5	0.001	250.0	2.270	Büyük Menderes	Irrigation and Drinking Water Supply
Kapıdere	17.9	17.9	0.000	150.0	0.661	Büyük Menderes	Irrigation
Sarıçay		47.7	0.000	419.0	1.590	Büyük Menderes	Drinking Water Supply
Kargın Brook			0.000	105.0	0.329	Büyük Menderes	Drinking Water Supply
Cılmbiz Creek	11.2	11.2	0.000	38.7	38.7	Büyük Menderes	İkizdere Dam Data Supply
Yalkı Creek	21.1	21.1	0.000	43.0	0.225	Büyük Menderes	İkizdere Dam Data Supply
Tabakhane Creek	20.2	20.2	0.000	15.6	0.373	Büyük Menderes	Aydın Drinking Water Data Supply
Madran Brook	41.2	41.2	0.000	86.0	0.950	Büyük Menderes	Irrigation and Flood Protection

Source: Aydın Province Environmental Status Report for 2015

Natural Lakes, Ponds and Reservoirs ¹²

Bafa Lake is the biggest lake in Aydın Province, and it is in the south east of the Menderes delta. The surface area of Lake Bafa is 65 km². 37 km² of it is located within the boundaries of Aydın province.

Lake Bafa is Class A Wetland. The lake was declared as a Natural Park and put under protection on 08.07.1994. It is located on the 37°29' North 27°28' East coordinates. The Gulf of Latmos, which was once a bay of the Aegean Sea, was covered with alluvials carried by the Menderes River and the Bafa Lake was formed as a result of the filling of the 300 km² bay. Administratively, it is located within the provincial borders of Muğla and Aydın.

The feeding of the lake is by precipitation in the lake area, seasonal streams, springs from the shores, underground springs and the connection with the Menderes River. The average depth of the lake, which is 2 meters in the north, reaches 21 meters in the middle. On the lake there are 4 islands with ancient ruins. The lake, which features ecologically rich food, has reeds in the southwestern part of the lake, along with the reeds in the northwest, there are tamarisk, willow and cogon grass communities. Fish production, which was over 300 tons before Menderes River and lake flood prevention impoundment was made, decreased significantly as a result of the decrease in water level, drying of the reeds and deterioration of ecological balance.

There are carp, bullhead, large carp, rudd and gray mullet in the lake. In addition to many bird species Pygmy cormorant and sea eagle, which are among the endangered species, incubate on the lake, which is extremely rich in terms of birds, and is used as a place of nutrition and shelter by hundreds of thousands of ducks and aquatic birds also in winter.

¹²Aydın Province Environmental Status Report for 2015

Azap Lake: Azap Lake is a wetland ecosystem with temperate climate conditions, and it is between Yeşilköy and Avşar Villages of Söke District of Aydın. Its surface area is 0.29 km². It is to the north of Bafa Lake and its altitude is 7 m.

Table 28. Current Irrigation Ponds in Aydın Province and Information About These Ponds

The name of the pond	Lake Volume	Irrigati on Area	Purpose of use
Akçaova Pond	2.89	337	Irrigatio
Hıdırbeyli Pond	4.85	273	Irrigatio
Çatak Pond	1.96	160	Irrigatio
Karacaören Pond	0.64	-	Domestic and Drinking Water for Animals
İbrahimkavağı Pond	0.34	81	Irrigatio
Gökçeburun Pond	0.929	108	Irrigatio
Kahvederesi Pond	0.29	32	Irrigatio
Kahvederesi-2 Pond	0.145	22	Irrigatio
Katrancı Pond	0.86	223	Irrigatio
Meriçler Pond	1.22	21.5	Irrigatio
Hamzabali Pond	0.69	100	Irrigatio

Source: Aydın Province Environmental Status Report for 2015

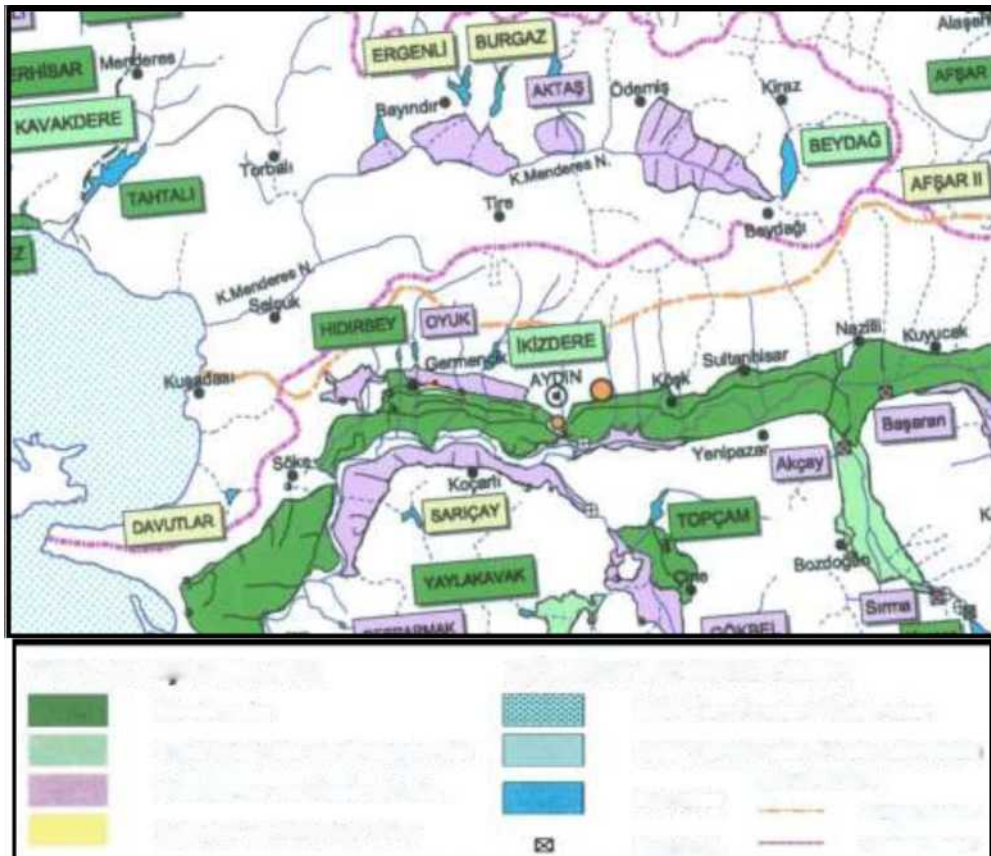


Figure 52. Current Water Use Status, Planned And Existing Irrigation Facilities In The Project Area
Source: DSI

The map showing the project area and the distance between Büyük Menderes River and Çamurlulıca Brook is given in Figure.53.



Figure 53. Map Showing The Project Area and the Büyük Menderes River

Source: Ministry of Environment and Urbanization, Atlas Geographical Database, January, 2017.

Lake-Pond-Dam

Lake, pond and dam characteristics are given in the table below.

Table 29. Dams in Aydın Province, Usage Areas and Distance to the Project Area

Item No	Name of Dam and HEPP Plant	Province-District	Purpose	Approximate Distance to the
1	Ikizdere Dam	Aydın- Incirliova	Irrigation	9 km
2	Topçam Dam	Aydın- Çine	Irrigation	37 km
3	Yaylakavak Dam	Aydın- Karpuzlu	Irrigation	35 km
4	Çine Dam	Aydın- Çine	Irrigation + Energy + Flood	61 km
5	Kemer Dam	Aydın-Bozdoğan	Irrigation + Flood + Energy	85 km

Source: DSI, <http://barajlar.dsi.gov.tr>, January, 2017.

Table 30. Ponds in Aydın Province, Characteristics and Distance to the Project Area

Item No	Name	Province-District	Purpose	Approximate Distance to the
1	Kavakderesi Pond	Aydın-Karacasu	Irrigation	86 km
2	Hıdırbeyli Pond	Aydın-Germencik	Irrigation	6 km
3	Akçaova Pond	Aydın-Çine	Irrigation	51 km
4	Çatak Pond	Aydın-Çine	Irrigation	48 km
5	Karacaören Pond	Aydın	Domestic + Animal Drinking	35 km
6	Kahvederesi Pond	Aydın-Karacasu	Irrigation	85 km

Source: DSI, <http://barajlar.dsi.gov.tr>, January, 2017.

The pond closest to the project area is the Hıdırbeyli Pond located at a distance of 5 km to the northwest of the project area.

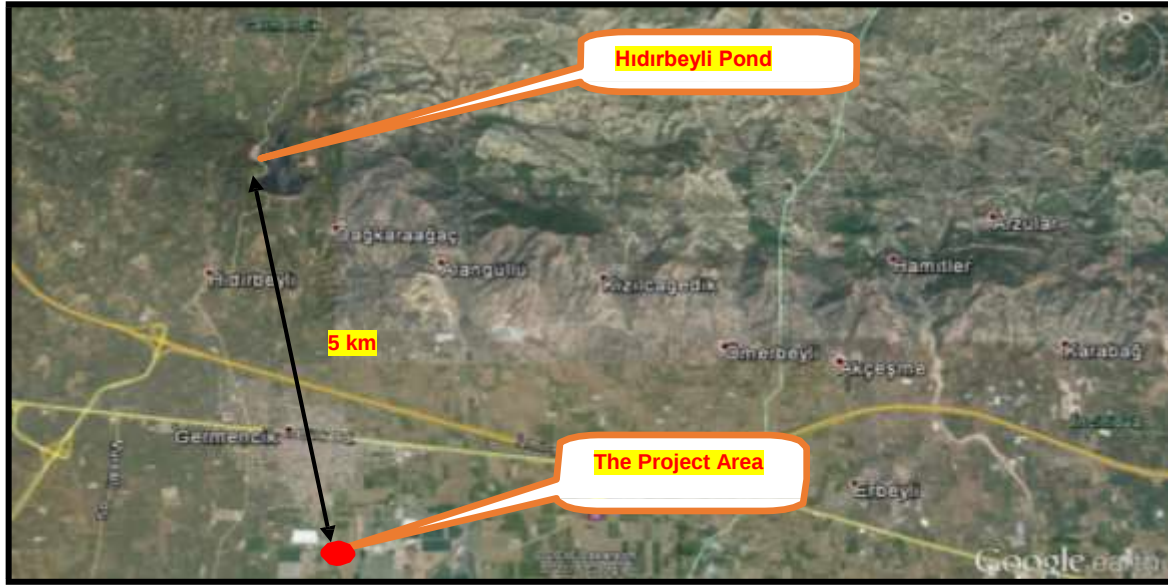


Figure 54. The Satellite Image Showing the Project Area Hıdırbeyli Pond

The dam closest to the project area is İkizdere Dam, located at a distance of about 11 km to the northeast of the project area.



Figure 55. The Satellite Image Showing the Project Area İkizdere Dam

Hydrological Effects and Measures to be Taken within the Scope of the Project

No detonation works shall be carried out in the project area. Strictly no interventions shall be made to the existing bed widths by preserving the natural beds of the existing creeks within and around the project area and no operations shall be carried out preventing the free flow of water.

There shall be no crossing or construction of artefacts for the construction and maintenance works of the transportation road, and if such a situation is needed, the necessary permits will be taken separately. No changes shall be made to the creek bed routes without the knowledge and permission of the DSI Regional Directorate.

DSİ administration shall not be held responsible for all kinds of damages and related legal problems that will be caused by floods and water pollution problems that will be caused by improper practices during the construction and operation activities.

In the monitoring program following the completion of the production and reinjection wells to be used within the scope of the project, a site groundwater monitoring program shall be established in terms of the whole aquifer system considering the EFE-7 Geothermal Power Plant and other power plants existing in the licence area as a whole. The monitoring wells shall be drilled in such a way that the production and reinjection wells shall be monitored according to the site distribution, and the monitoring wells shall be insulated by closed pipe and cementing from the well mouth to the observation level. Continuous temperature, ph, ec monitoring values shall be transmitted to DSİ Regional Directorate by placing limnigraph in the wells. The approval of DSİ Regional Directorate should be obtained in drilling the observation wells.

In the operation phase of Efe-7 GPP facility, which is planned to be installed and operated, in case pipelines belonging to the planned geothermal power plant, energy transmission lines etc., which are not registered in the name of State Hydraulic Works, but which are constructed and operationalized by State Hydraulic Works are built; a protocol including the transition conditions shall be prepared and discussed with the DSİ Regional Directorate. In case the transitions related to the planned project are made for the immovable properties registered in the name of State Hydraulic Works, easement right shall be established. In case the mentioned transitions are designed; Transition and easement projects shall be prepared and submitted to the Regional Directorate of State Hydraulic Works (DSİ) before the transition to the construction phase. The construction activities shall not be started for the transitions related to the facilities under the responsibility of the DSİ without ensuring mutual agreement agreement on the protocols regarding transitions conditions and easement right is established for the transitions requiring establishment of easement right.

During the construction and operation of the Efe-7 Geothermal Power Plant project, no intervention shall be made to the State Hydraulic Works facilities and the water transmission of the facilities within the State Hydraulic Works shall not be prevented.

During the works to be carried out within the scope of the project, provisions of Law on Groundwater, Regulation on the Protection of Groundwater from Contamination and Degradation, Regulation on Control of Water Pollution shall be observed.

During the construction and operation phase of the project, material and waste shall not be dumped into the surrounding creek beds, no harm will be made to the existing flood protection structures, no activity shall be carried out influencing the flow of the creek and the provisions of the Prime Ministry Circular on "Creek Beds and Floods" numbered 2006/27 will be observed.

II.2.5. Characteristics of the Geothermal Resource (Potential of the Geothermal Resource, Levels, Other Geothermal Resources in the Region and Relation with the Basin)

The geothermal license area J-553 is located within the boundaries of Aydın Germencik-Incirliova District and is approximately 3,530 hectares. The site is a high temperature water-dominant geothermal resource.

Chemical Properties of Geothermal Waters ¹³

Geothermal fluids are renewable and environmentally friendly natural resources and are widely used by different countries today (Ilgar, 2005). These geothermal fluids, which are provided as hot water, wet or dry steam, contain highly dissolved chemicals and highly rich mineral salts. It is also directly utilized in different areas at temperatures ranging from high to low temperatures for non-electric uses.

Geothermal energy corrodes and dissolves the magmatic originated rocks and plutonic rocks, acquires their mineral and salt characteristics with the superiority it has due to high temperature and outcrops as hot water, wet or dry steam (Mutlu, 2004; Ilgar, 2005; Gürü, 2005). In the studies conducted to determine the chemical content of this emerged geothermal and the quantities of these materials, it is stated that the content is characterized by the macro elements existing in the reservoir rocks and underground environment conditions, that the materials contained in it and their proportions change according to their location, that they are richer than natural waters in terms of molten salt and mineral types and amounts and they have higher temperature and pressure (Gemici and Tarcan, 2002; Tarcan and Gemici, 2003; Küçükne vd., 2004; Gemici et. al., 2004)

Thermal waters contact the rocks along the medium they pass through and they dissolve some substances due to their temperature and carry them together. The density of dissolved substances in the geothermal fluid, which consists of hot water, steam and gases, varies depending on the water-rock relationship, duration and ambient temperature. The circulation of the geothermal fluid in a geothermal site, its type, origin, age, feeding height and mixing rates with other waters can be explained with thermal water chemistry. Chemical analysis of thermal waters is also important in order to determine the environmental impacts to be formed in air-water-soil due to the harmful substances contained in the geothermal waters in case they are discharged to nature. Although the energy production and heating systems, which are the most intended use of geothermal resources, are known as clean, they are not completely clean due to the liquid and gas, and involved substances discharged to the nature. Determining the harmful effects of these substances and control of them, if necessary, requires correct methods of analysis.

The amount of dissolved chemical substances in geothermal waters is high. The solubility of the elements depends on the water - mineral balance and it is mostly mineral. The quantities of the elements vary depending on the temperature and the characteristics of the environment. Water chemistry data can be used to explain the temperature of the geothermal systems, feeding and discharge zones, and mixing ratios with other waters.

¹³ Alangüllü (Aydın) Jeotermal Kaynağının Kimyasal Özellikleri Ve Çevreye Olan Etkilerinin Uzaktan Algılama Ve Cbs Kullanılarak Belirlenmesi [Chemical Properties of Alangullu (Aydın) Geothermal Resources and the Determination of the Resource's Environmental Effect by Using Remote Sensing and GIS], Emrah Aslan, İzmir, 2010

In environments, where geothermal waters are existent, the relationship between water and rock and the reaction rate to be formed are a function of temperature. The temperature usually affects the reaction rate. Each 10 ° C increase in ambient temperature increases the reaction rate 2-3 times. Therefore, the reaction rate in an ambient temperature of 200 ° C is about 210 -3 10-times higher than the other medium having a temperature of 20 ° C. It is evidence that the rocks are more altered in high temperature environments. The results of the geothermal chemical analysis revealed that the geothermal fluids contained chemical substances and rich mineral salts such as sodium (Na), calcium (Ca), magnesium (Mg), chloride (Cl), nitrogen (nitrogen, N₂), hydrogen (H), mercury (Hg), bicarbonate (HCO₃), hydrogen sulphide (H₂S), sulphate (SO₄), silicon dioxide (SiO₂), ammonia (NH₄), carbon dioxide (CO₂), methane (CH₄), potassium (K), fluoride (F), iron (Fe), boron (B), lithium (Li), copper (Cu), radon (Rn), manganese (Mn), nickel (Ni), lead (Pb), arsenic (As), zinc (Zn), carbonate (CO₃) dissolved in high concentrations (Lund et. al., 1978; Mahon et al., 2000; Akıllı and Ersöz, 2002; Yeşin, 2003; Tarcan, 2003; Tarcan, 2005; Data and Bahati, 2003; Mutlu, 2004).

The characteristics of the geothermal source in the region are found out in the Aydın-Germencik Jeotermal İşletme Ruhsat Sahaları Jeoloji-Hidrojeoloji-Jeofizik Potansiyel Değerlendirme ve Üretim/Reenjeksiyon Kuyu Lokasyonları Belirleme Danışmanlık Raporu [Aydın-Germencik Geothermal Plant License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production/Reinjection Well Location Detection Consultancy Report], prepared by Prof. Dr. Şakir ŞİMŞEK and these information are provided in the following.

Physical Properties of Waters

The reservoir temperature is above 200 ° C in the wells in the area. The maximum temperature value (239.51 ° C) was measured in the ÖB-30 well. In HB-1 and HB-2 wells in Hıdırbeyli at the north of the site, the temperature is lower, and it is measured as 120-142 ° C. Germencik site has a water-dominated high-temperature site character.

The electrical conductivity (EC), which is an indicator of total ionic concentration of the waters, has high values in the range of 4200-8790 µS/cm. Although the pH values vary depending on the conditions measured, its range is between 6.7-9 according to the measurements made in the drilling wells during the tests. According to this, the waters in the area are close to neutral or slightly basic.

Chemical Properties of Waters

The results of the chemical analysis of the waters in the Germencik geothermal area were investigated and the relationships between the waters and the lithology were evaluated. According to the dominant ion sequence of Meq/l concentrations, the anions of water other than the ÖB-7 water sample in the region are Cl>HCO₃>SO₄ and the cations are in the form of Na + K>Ca>Mg and they are in the NaCl type of water. The ÖB-7 is in the NaHCO₃ water class.

Örnek No	T (°C)	pH	EC (µS/cm)	Na	K	Ca	Mg	CO ₃	HCO ₃	Cl	SO ₄	B	SiO ₂	Hakim Katyon Sıralaması	Hakim Anyon Sıralaması
ÖB-1*	203	7.21	6500	1440	60	50	1	0	1140.2	1505.3	125.9	31.1	140	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-2*	232	6.71	7200	1445	135	30	1	0	1419.5	1559.8	33.3	31.3	160	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-3*	232	8.78	7100	1775	170	1.6	0.5	204	1342	1818	74	68	55	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-4*	217	7.71	5400	1420	135	12	1.7	0	1440	1500	37	55	53	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-5*	225	8.43	3000	1387	128	84	6.8	66	1409	1454	46	56	209	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-6*	224	8.70	6200	1775	180	3.6	0.5	298	1202	1882	64.2	74	41	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-7*	227	7.53	4200	1100	132	19	6.1	0	1837	855	51	56	214	Na+K>Ca>Mg	HCO ₃ >Cl>SO ₄
ÖB-8*	220	7.08	6600	1410	122.5	62.5	1.5	0	1396.7	1488.9	96.02	29	286	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-9*	224	8.20	6500	1440	140	85	10	336.5	860.8	1542.1	43.62	27.8	286	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-10**	225*	7.4	6690	1489	264	6.2	0.9	0	1546	1580	68.8	55.7	440	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-11**	212	7.1	6600	1538	130	13	0.7	0	1619	1489	16	57	430	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-14**	228	7.8	7500	1565	175	12.3	0.7	106	1461	1565	20	67	449	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
AG-22**	204	6.9	6900	1330	62	31.4	0.86	0	1183	1778	21.2	17	-	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
AG-25**	194	7.2	6500	1373	169	2.03	0.5	0	1379	1511	29.3	42.9	445	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-17**	-	7.5	7360	1512	233	3.3	0.1	0.0	1717	1615	35.0	56.7	589	Na+K>Mg>Ca	Cl>HCO ₃ >SO ₄
ÖB-19**	-	7.5	7210	1464	225	3.4	0.1	0.0	1689	1599	33.2	58.1	530	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
AG-28A**	-	9	8320	1833	223	0.5	0.5	0.0	1166	1812	47.0	62	304	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
HB-1***	120	8.30	6040	1554	104	6	18.1	121	1699	1501	43.6	56.1	64	Na+K>Mg>Ca	Cl>HCO ₃ >SO ₄
HB-2***	142	8.10	5510	1369	98	16	1.2	34.6	1541	1399	25.1	50	201	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄
ÖB-30****	239.51	8.50	8790	2082	358	1.82	0.5	301	1387	2255	41.7	66	578	Na+K>Ca>Mg	Cl>HCO ₃ >SO ₄

*MTA,1968-2005 **GÜRMAT, 2006-2010 ***MTA, 2008 ****MTA, 2011

Figure 56. Results of Chemical Analysis of Drilling Well Waters in Germencik Geothermal Field (Concentrations are taken as Ppm)

Origin Characteristics of Waters

Semi-logarithmic Schoeller and Piper diagrams were created in order to show the similarities and differences between the hot and cold waters in the region.

The locations of waters in the Piper diagrams reveal that all well water has the Na-Cl character (salty water) and their clustering in the same are indicates the similarity of the geothermal reservoirs. In the semi-logarithmic (Schoeller) diagram for the wells drilled in the Germencik geothermal field, it is observed that the waters are generally enriched in Na-Cl, indicating the presence of the seawater mixture (paleo).

II.2.6. Other Geothermal Resources in the Region and Their Utilization (Energy, Tourism, Heating, Heating, Greenhouse etc.)

Aydın province has the richest geothermal fields in Turkey ever. There are approximately 70% of geothermal potential in our country in the collapse area, which is located between Aydın-Ortaklar and Denizli-Sarayköy districts and called Büyük Menderes Graben.

The studies carried out in the region have been elaborated separately for each site and has been compiled for the MTA General Directorate Geothermal Energy Inventory Studies as Aydın Province Geothermal Sites Inventory and it has been updated with the new data by using the operating reports of the license areas granted by the Aydın Province Special Administration in addition to the existing inventory data.

In this inventory study conducted by the MTA General Directorate, the geothermal fields are listed as a series of resources in the Menderes Graben from east to west as it can be seen from the Geothermal Sites Map of Aydın Province.

The geothermal sites and their features in the region were compiled in Figure.57.

JEOTERMAL ALAN ADI	SICAK SU DOĞAL ÇIKIŞ ADI	DOĞAL ÇIKIŞ			SONDAJ			KULLANIM ALANI	KURULU TESİS	DEĞ. BEL.
		Sıcaklık (°C)	Debi (lt/sn.)	Potansiyel (MWt)	Sıcaklık (°C)	Debi (lt/sn.)	Potansiyel (MWt)			
YILMAZKÖY	İlicabaşı	34-38	1,1		84-142	47	19	Kaplıcada ve kaplıca tesisi ısıtılmasında	-	***
GERMENCİK-ÖMERBEYLİ	Ömerbeyli Sahası				203-232	725	594,83	Elektrik üretimi, ve reenjeksiyon kuyularına bağlı diğer uygulamalar, şehir ısıtması-soğutması, sera ısıtması, kurutmacılık (incir üzüm) Tekstil endüstrisi (İplik), soğuk hava depoları,kaplıca ve kaplıca tesisi ısıtılmasında	-	***
BOZKÖY-ÇAMUR	Bozköy-Çamur	36-92	4		59-142	280	107	Kaplıcada, kaplıca tesisive sera ısıtılmasında	Kaplıca	***
SALAVATLI	Salavatlı				167-172	93,8	53,79	Elektrik üretimi ve reenjeksiyon kuyularına bağlı diğer uygulamalar, şehir ısıtması, soğutması, sera ısıtması, kurutmacılık, endüstriyel proses ısı, kaplıca ve kaplıca tesisi ısıtılması	Kaplıca	***
SULTANHİSAR	Sultanhisar				145-146	200	89			
MALGAÇEMİR-GÜVENDİK	Güvendik	38	0,5					Termal turizm		
ORTAKLAR-GÜMÜŞ	38,7							Kaplıcada, kaplıca tesisi ve sera ısıtılmasında	Kaplıca	***
SÖKE-SAZLIKÖY	Sazlıköy	27								
KUŞADASI	İlica		-	-	26	3	-	Kaplıcada, kaplıca tesisive sera ısıtılmasında	-	**
BUHARKENT-ORTAKÇI	Ortakçı	51	0,3		-	-				**
NAZILLI-GEDİK	Gedik	32	-		36	1	1			**
DAVUTLAR	Davutlar-Karina	26-42	-							**
UMURLU-SERÇEKÖY					124-155	116	143			**
ATÇA					63-124	95	35			
PAMUKÖREN					188	58	37			
ÇİFTLİK	-	-	-	-	58	35	3,37	Isıtma, termal turizm		

* MTA, 1996. Türkiye Jeotermal Envanteri

** MTA, 2005. Türkiye Jeotermal Kaynakları Envanteri

*** DPT, 2001. 8. Beş Yıllık Kalkınma Planı Madencilik Özel İhtisas Komisyonu, Enerji Hammaddeleri Alt Komisyonu Jeotermal Enerji Çalışma Grubu raporu, Not: Sondajlardaki potansiyel değerleri, kuyuların ilk üretim debilerinin toplamına göre hesaplanmıştır.

1- Kuyuların ilk üretim debilerinin toplamına göre,

2- Yüksek sıcaklıklı sahalarda (sıcaklığı 100°C nin üstünde) rezervuar sıcaklığına göre hesaplanmıştır.

Figure 57. Geothermal Resource Sites in Aydın Province

Source: Mineral Research and Exploration Institute

The sites suitable for generating electric energy by reservoir temperature in the Aegean region are given in Table.31.

Table 31. Geothermal Areas Suitable for Energy Generation by Reservoir Temperature

District	City	Reservoir Temperature °C
Germencik	Aydın	237.00
Kızıldere (Buharkent)	Aydın	242.00
Salavatlı	Aydın	171.00
Yilmazköy	Aydın	142.00
Tuzla	Çanakkale	174.00
Seferihisar	İzmir	153.00
Balçova	İzmir	136.00
Dikili	İzmir	130.00
Simav	Kütahya	162.00
Kurudere (Alaşehir)	Manisa	184.00
Göbekli (Alaşehir)	Manisa	182.00
Caferbey (Salihli)	Manisa	150.00

II.2.7. Current and Planned Use of Surface Water Resources, Basin Characteristics, if any (Drinking, Domestic, Irrigation Water, Electricity Generation, Dam, Lake, Pond, Aquaculture Production Production Type and Amount, Waterway Transportation Facilities, Water and/or Shore Utilization for Tourism, Sport and Similar Purposes, Other Uses)

The largest stream within the boundaries of Aydın Province is the Büyük Menderes River, which flows from East to West and flows into the Aegean Sea from Söke West. Some of the creeks connecting to this river are Alangüllü Brook, Kavaklı Creek, Oyuk Creek, Yalkı Creek and Cılımbız Creek.

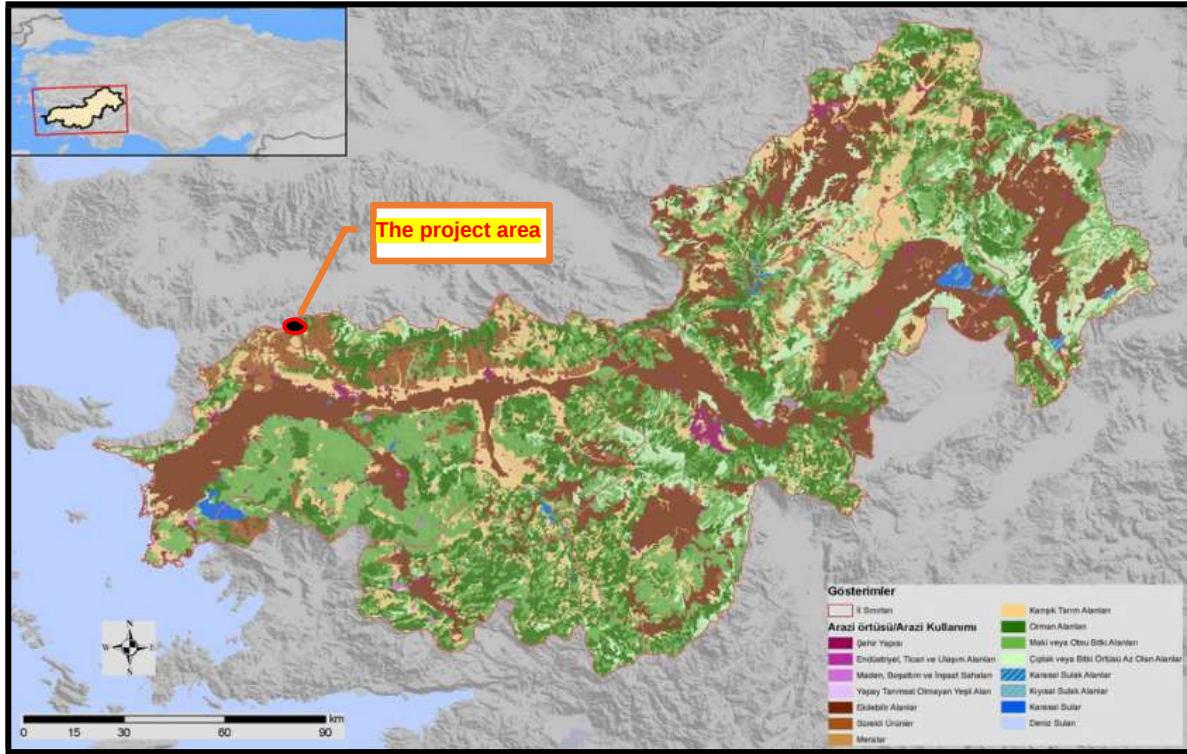


Figure 58. Büyük Menderes Basin

The nearest stream to the project area is the Büyük Menderes River, which is about 6 km to the south of the facility area and the Çamurlulıca Creek located at a distance of 300 meters.

The pond closest to the project area is the Hıdırbeyli Pond located at a distance of 5 km to the northwest of the project area.

The dam closest to the project area is the İkizdere Dam, located at a distance of 11 km to the northeast of the facility area.

Current and planned use of surface water resources of the project area and its vicinity and basin characteristics are provided in Section II.2.4 "Hydrological Characteristics".

II.2.8. Soil Characteristics and Utilization (Soil Structure, Land Use Capability, Classification, Carrying Capacity, Slope Stability, Slipperiness, Erosion, Use for Soil Works, Pasture Meadow Etc. Used as Natural Vegetation,)

Various types of soil is seen in Turkey due to the high diversity of climate, the different structures of the bedrocks in the fields, the diversity of vegetation, the elevations and the differences in the ground patterns. Some of these soils are elaborated in Table.32.

Table 32. Soil Types in Turkey

Alluvial soils	These are soils formed by accumulation of materials such as sand, alluvion, clay and gravel that are eroded by the rivers and flood waters in places where slope decreases. This type of soil is generally seen in streams, valleys and plain bases, in the alluvial cones where the slope decreases and deltas. These soils which are extremely fertile are extremely important for our country's agricultural economy.
Terra rossa soil	These soils formed in the areas covered with limestone in the Mediterranean climate are red in colour. It is mostly seen in the Mediterranean Region in our country.
Brown forest soil	This type of soils has been developed especially in the areas covered by broadleaf forests of the Black Sea and Mediterranean regions. These lands which are rich in humus are efficient.
Podzolic soil	They are pale coloured infertile soil generally seen in needle-leaved forests in Western Black Sea.
Lateritic soil	Soils resembling laterites are seen in the coastal part of the Eastern Black Sea Region, which resembles the hot and rainy climate of the equatorial region.
Chestnut and brown steppe soil	These soils seen in the steppe regions where there is little rainfall in the Central Anatolia, Southeast Anatolia and Eastern Anatolia regions. It is generally used for grain cultivation.
Chernozem	These soils seen in Erzurum - Kars plateaus are rich in humus since they develop under the lush grasslands formed by summer precipitation. Therefore, they are dark coloured soils.
Salty soils	These soils seen around the Salt Lake are infertile.

General map of soil types in Turkey is given in Figure.59.

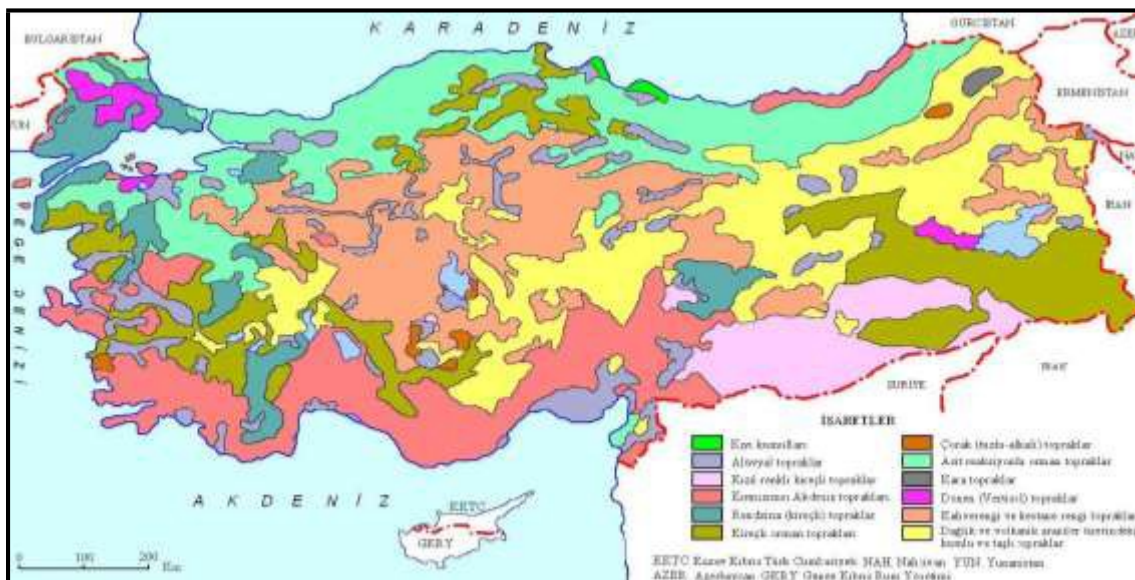


Figure 59. Map of Turkey's General Soil Types

Soil₁₄

Aydın Province has extensive agricultural lands irrigated with B. Menderes River. The land close to the B. Menderes River is generally composed of 1st class and Alluvial soils. This fertile land extends westward from the borders of Kuyucak district in the east and extends in an area of approximately 10 km in the north-south direction. The most fertile land within the provincial boundaries is located in Nazilli, Sultanhisar, Kosk, Incirliova, Kocarlı, Germencik and Soke Districts. In addition, near the Çine district in the vicinity of Akçay and Çine District located in the boundaries of the Bozdoğan District, there are alluvial and colluvial 1st class agricultural lands. Soils were classified in the upper category which is based on the pedogenetic and physical properties of the profile at the level of Major Soil Groups. Characteristics of the soil in the province of Aydın are the following;

¹⁴Aydın Province Environmental Status Report for 2015

Aluvial Soils (A): They are often described as young soils on fresh sedimentary deposits. There are no horizons, if any, they are very poorly developed, on the other hand the mineral layers of different characteristics, (A) are C profiles are found; The materials forming these soils are carried in a state of suspension by the streams and stored. Mineral compositions are heterogeneous and are continuously or seasonally damp, they are mostly under the influence of ground water. Mild limewash may be present in those which are very old. In the presence of ground water, desertification can be observed in the soil profile or on the surface.

Colluvial Soil (K): These lands, which are formed on the material called colluvium, are deposited on the piedmonts of the steep slopes by means of gravity, landslide, surface flow or tributary rivers and are young (A) C profile soils. Soil characteristics do not resemble those of high land soils.

In these soils, the colour depends on the material which they are formed. Their structure is coarse. Their drainage is good due to their slope and structure and they do not have salinity or alkalinity. Since the gravels in the profile are carried from a short distance, these soils are occasionally flooded.

Chestnut Soils (C): The main substance ranges from limestone to limestone rich volcanic material. The profile is AC, A(B)C or AB C. The horizon A is dark brown or greyish brown. This horizon is 30-50 cm thick, granular and has scattered consistency.

The horizon B is brown, dark brown or reddish brown. The structure is weak prismatic. Accumulation of clay is seen in this horizon (B). Under the B horizon, mostly hardened lime deposition horizon is located. A gypsum accumulation horizon may be present under it.

Reddish Chestnut Soils (D): These soils are formed as a result of calcification of different main substances. Natural drainage is good. Horizon A is in dark reddish brown and has scattered and neutral or alkaline reaction. Horizon B is heavier and harder. At the top of this horizon, the colour changes from reddish brown to red, while in the lower layer the colour is slightly lightened or slightly greyed. The lower part has more limestone.

Red Mediterranean Soil (T): The most prominent characteristics of these soils is that the whole profile is tile red colour and the organic matter in the upper soil is rare. Soil carbonates are washed, heavy clay. Horizon A has very uniform red colour. Below it is horizon B (Bt) with red, heavier structure and distinct clay membranes.

Red Brown Mediterranean Soils (E): These soils are the transition between Red Mediterranean Soils and Brown Mediterranean Soils. These soils have ABC profile. Horizon A has a well-developed medium organic substance and organic substance and mineral substance are thoroughly mixed. It can be seen with a weak horizon A. The horizon A gradually passes through the structural horizon B with red or brown, angular block and prismatic structure.

Regosol Soils (L): Regosols are very young soils and are found on deep soft mineral deposits. Only A and C horizons are formed in these soils. Horizon A is poorly formed, shallow or moderately deep and does not make a transition to the horizon C. They are over-drained due to their high permeability and low retention capacity.

Lime-free Brown Forest Soils (N): The soils in this group are composed of different bedrocks. The colour and the base state will vary depending on the amount of main material and organic matter. It is difficult to distinguish the horizon B in these soils. Horizon B is sometimes slightly enriched with silicate clay minerals and may have structural elements. This horizon is absent in many parts and there is a horizon C1 just below A1.

Lime-free Brown Soils (U): Weak podzolization and some calcification plays a role in the formation of these soils. Horizon A is brown, reddish brown, greyish brown, yellowish brown or red and soft or slightly tight. The horizon B is heavier, harder, brown or reddish brown. There is more redness in this part. This horizon is normally limewashed, but the reaction is neutral or alkaline. The transition from A to B is gradual.

The main substance of this soil is different. Soils can be formed on the limestone as well as on the acid main substance. Natural drainage is good.

Rendzinas (R): Since it is included in the calcimorphic group of interzonal soils, it takes all its properties from the main substance having high degree of lime. The horizons are very weak compared to the surrounding zonal soils and have AC profiles .

Horizon A is thin and granular and have dark and alkaline reaction. It is neutral when it is not alkaline. The organic matter is thoroughly mixed with mineral material due to the rich limestone. The amount of organic matter and soil depth are higher than the lithosols and regosols formed on the calcareous material. CaCO₃ is distributed throughout the entire profile. Base saturation is high in the entire profile. Natural vegetation is grass, meadow and shrub.

The series takes place in mild, cold and humid climates. The annual average of precipitation is 500-750 mm.
The main substance is limestone, dolomite, marl, chalk.

Alluvial Shore Marshes (Sv): Located on the shores of lakes and seas, they are soils which remain damp or in the form of marshes continuously or for a large part of the year due to lakes or seas and surface flows. They may be salt-free, slightly salty, alkaline. These lands, which do not have agricultural values due to their properties, serve as prey animal shelter.

Saline-Alkaline Soils with Poor Drain (Hv): The fact that the topographies are plain, or concave causes these soils, especially the lower levels, to be constantly damp due to high ground water. The rises and declines in the ground water lead to successive oxidation and reduction of the soil layers on the ground water. Thus, bluish-gray reduction and reddish oxidation stains occur. Rust stains occur particularly in cracks and root canals.

Aydin Province Soil Structure ¹⁵

Soil Structure: In the classification according to saturation percentage, 59.1% of the agricultural lands have loamy, 30.4% have clayish-loamy, 9.1% are clayish and 1.4% have sandy structure. This distribution shows the existence of adequate soil structure for agriculture in the province.

Soil Reaction (pH): 13.6% of agricultural soils are acid, (pH less than 6.5) 28,3% of them have neutral (pH 6,6-7,5) and 58,1% of them have alkaline (pH greater than 7.5) reaction.

Soil salinity (total salt %): 93.5% of the tillage agricultural land is salt-free, 5.1% is slightly salty, 1% is medium salty and 0.4% is very salty. Soils which are very salty and medium salty are problematic such that they can prevent plant development.

¹⁵Aydin Province Environmental Status Report for 2011

Lime in the Soil (CaCO_3): In Aydın province 34.5% of the agricultural lands are slightly calcareous, 20.4% are the medium calcareous, 22,67% is calcareous, 17,6% is very and 4,97% is heavy calcareous.

Organic Matter: Most of the agricultural land is poor in terms of organic matter. According to the average of analysis results; in 69.6% of the soils, organic matter is very low, and it is low in 30.4%. These soils require to be fertilized with nitrogenous fertilizers. Climatic characteristics and erosion play a major role in this situation. It is necessary to apply the measures to increase the amount of organic matter for the continuity and increase in fertility.

Phosphorus: In the phosphorus determinations available by plants (according to Olsen method); 63.9% of the agricultural lands were found to be phosphorus deficient, 19.3% were medium and 16.8% were rich. According to this assessment, phosphorus deficient soils should be reinforced with phosphorus fertilizers.

Potassium: Geological structure and climatic condition cause excessive accumulation of potassium in soils. In the province, 0.17% of the land has low, 2.7% of the land has medium, 3.9% of the land has sufficient, 93.3% of the land has excessive amount of potassium was detected.

Project Area Soil Structure and Land Use Capability Classification

1/25.000 scale land asset map including the EIA area within the scope of the planned project is given in Annex-3. EIA Area is mainly located in II. Class soil groups according to the Map of Land Assets provided in Annex-3.

The project area is considered as S-irrigated farming land for its land use and A - Alluvial soils class as the major soil group.

Erosion:

The soil in the project area is in a structure with shallow, very shallow and lithosolic characteristic, it is subject to severe and very severe water erosion in terms of erosion degree.

There is no creek with continuous flow within the project area. However, there are creek beds that show temporary flow depended on the precipitation.

Erosion is the phenomenon of removal, transportation from one place to another and accumulation of soil on the earth's crust, especially by rivers and various external factors. Erosion is divided into water and wind erosion:

Wind Erosion: It is the phenomenon of the transportation of the soil due to hard and strong wind. As a result of the wind erosion, the fertile soil disappears, the soil moisture decreases due to the acceleration of evaporation, the plant growth slows down, and the transportation is disrupted due to the filling of the soil. In addition, transported sand and infertile soil, covering the fertile agricultural land, makes agriculture impossible.

Water Erosion: Water erosion is the most common and most effective type of erosion. For this reason, when soil erosion is mentioned, water erosion comes to mind. 86% of the land of Turkey is subject to erosion.

Thus, the area affected by water erosion reaches up to 66.9 million hectares. In terms of the way the water erodes and transports the soil it can be divided into 5 as in the following;

- Splash erosion
- Sheet erosion
- Rill erosion
- Gully erosion

- The erosion caused by stream beds.

Splash erosion is the erosion caused by the eroding of the soil at the time of the precipitation due to spattering of the soil with its energy. This type of erosion causes the most serious eroding and transportation. One of the most important factors in preventing this erosion is having soils covered with vegetation. This type of erosion is more effective than the flowing water although it is an erosion that is effective only when the rain first starts. The diameter of the raindrop is also directly proportional to the damage it gives.

Sheet erosion is the type of erosion that the non-infiltrating water begins runoff and is mixed with the particles and fragmented aggregates on the soil surface.

Rill erosion, With the continuation of the runoff, the erosion increases, and rills are formed after a certain stage. Erosion continues with acceleration with the formed rills. Such erosion is called "rill erosion".

Gully erosion, After a later stage of the rill erosion, the rills begin to become wider and deeper. Gullies form bigger than the rills and this is called gully erosion.

Erosion caused by stream beds, streams erodes the beds they flow over in width and depth and this type of erosion is called "Erosion caused by stream beds". The eroding depends on the flow rate of the stream.

Wind erosion, splash erosion and sheet erosion are the most encountered erosion types in the project area.

Based on these principles, necessary measures shall be taken in the operation site to combat erosion at the production stage.

During the operation; the relevant provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" issued on 08.06.2010 with Official Gazette numbered 27605 shall be observed.

II.2.9. Agricultural Areas (Whether There Are Agricultural Areas, If Any, Agricultural Development Project Areas, Size of Irrigated and Dry Agricultural Areas, Product Patterns and Their Annual Production Quantities, Role of Products in Country Agriculture and Their Economic Value)

Agriculture and stock raising industry in Aydın province, which has one of the most cultivation areas by regional surface area in Turkey, started to show itself countrywide in the recent period also in terms of product variety. Among the factors that led to this are that the terrain is not too hilly, presence of wide plains and the widespread use of mechanised farming, the ease of transportation in the development of agriculture in the region, the prevalence of irrigation, and the high number of consumer population. The fact that three different climate types are observed in the region at the same time leads to an increase in the agricultural product variety.

Some of the population living in Aydın is engaged in agriculture, and 55% of the total population make a living from agriculture. The weight of agriculture, which forms the basis of economic life, is also felt in industry and trade sector. 90% of industrial production is directly or indirectly based on agriculture.

Agricultural products and production quantities for Aydın Province, where the project is located, are given in the tables below. ¹⁶

¹⁶ Source: Ministry of Food, Agriculture and Livestock, Directorate of Strategy Development, Agricultural Investment Guide

Table 33. Agricultural Areas and Number of Farmers

Parameter	Area
Total Agricultural Area (2015)	3,681,002 da
Number of Farmers Registered in ÇKS (2015)	51,009 People
Land Assets Registered in ÇKS (2015)	2,567,479 da

Table 34. Distribution of Agricultural Areas and Production Amount

Parameter	Area	Year 2015 Production (ton)
Field Crops	1,379,845	2,580,000
Fruit	2,156,419	761,000
Vegetable	108,173	343,000

Table 35. Field Crops Data

Parameter	Year 2015 Production (ton)
Maize (Green-Silage)	1,040,328
Green Grass	900,432
Cotton	287,473
Maze (Grain)	147,666
Wheat	75,087

Table 36. Fruit Growing Data

Parameter	Year 2015 Production (ton)
Olive	297,240
Fig	186,124
Strawberry	60,833
Orange	55,779
Mandarin	27,140

Table 37. Vegetable Growing Data

Parameter	Year 2015 Production (ton)
Tomato	149,977
Watermelon	65,451
Pepper	27,951
Melon	14,162
Aubergine	12,779

Table 38. Agriculture and Agriculture-Based Industry

Parameter	Numb	Parameter	Numb
Milk and milk products	197	Production of bread and bread types	309
Meat and meat products	21	Pasta and Semolina Production	-
Aquaculture Processing	-	Egg Packaging	16
Fruit-vegetable processing-packaging	199	Frozen food	-
Cereals and Pulses Production	2	Catering, Fixed Menu	47
Solid and Liquid Vegetable Oil	3	Ready-made soup and bouillon, pudding, powder mixtures, mayonnaise, sauce etc	-
Sugary Products	39	Nuts and Cookies	38
Olive oil	2	Spice Processing	29
Canned Food and Paste	-	Soft drinks	10
Production of fermented and pickled products	55	Alcoholic beverages	4
Pastry Products Production	351	Production and packaging of honey, pollen, royal jelly and basic honeycomb	14
Starch and starch products	-	Food Additives and Flavorings	-
Biscuit, Chocolate, Cocoa and Related Products	2	Food Contact Materials	6
Flour production	3	Forage	331
Production of bakery products	77	Other	6

II.2.10. Forest Areas (Forest Area Quantities, Types and Number of Trees in These Areas, Coverage Area, Closure and Properties, Current and Planned Protection and/or Usage Purposes, If the Project Area is Not a Forest Area Distance of the Project Area and its Units to the nearest Forest Area, 1 / 25.000 Scaled Stand Map)

Although 36% (326,649 hectares) of the province of Aydın is covered with forests, forestry activities are not developed. Only about 2% of the active population in the forestry area in the province of Aydın, which has approximately 154 villages in the forest and adjacent to the forest, benefits from forestry. Nevertheless, nearly 3.8% of forestry revenue of Turkey is supplied from Aydın.

47% of the provincial forests, which have spread over an area of approximately 326,649 hectares, is grove and 53% is coppice. Approximately 32% of the groves are fine grove and nearly 4% of the coppices are fine coppice. ¹⁷

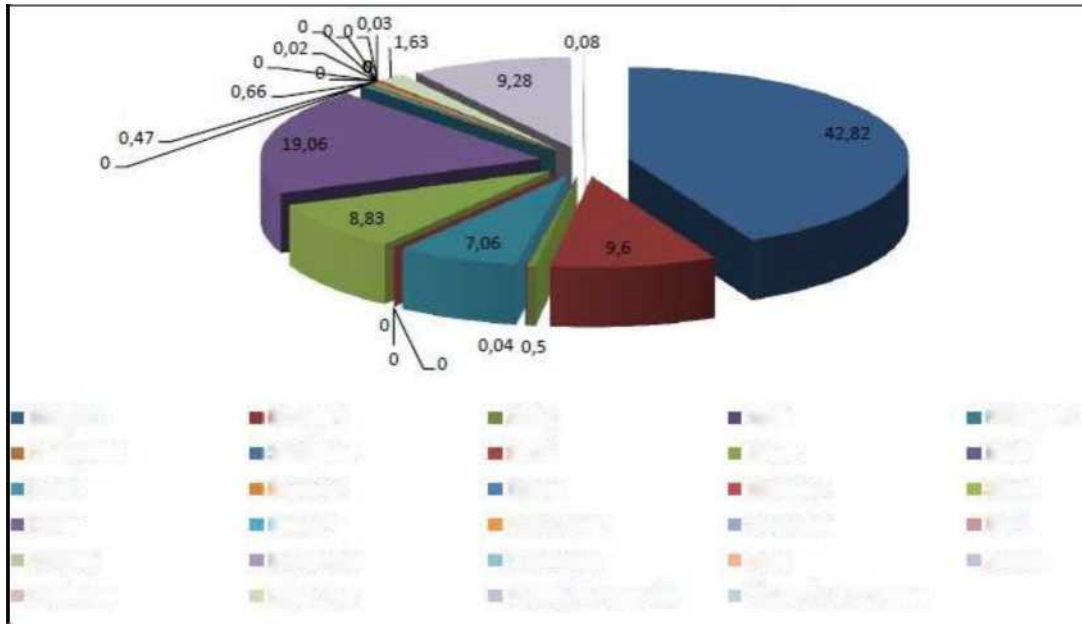


Figure 60. Aydın Province Tree Species

The planned project is not within the forest lands. In Figure.61, the location of the forest areas closest to the project area is given. Forest land is located 1.5 km southeast of the Project site.

¹⁷Aydın Province Environmental Status Report for 2011



Figure 61. Project Area and Nearest Forest Areas

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr>, January, 2017.

The project area is in an agricultural area according to 1 / 100.000 scaled Aydın-Muğla-Denizli Region Environmental Plan. There are no areas identified as areas to be conserved and subject to construction ban in the project area.

When we look at the 1 / 25.000 scaled Land Assets Map prepared for the Efe-7 Geothermal Power Plant Project and presented in Annex-3, it is seen that the project area is located in an irrigated agricultural (S) area.

II.2.11. Conservation areas (Demonstration of the Distance to National Parks, Nature Parks, Wetlands, Natural Monuments, Natural Conservation Areas, Wild Life Conservation Areas, Biogenetic Reserve Areas, Biosphere Reserves, Natural Protected Areas and Monuments, Historical, Cultural Protected Areas, Special Environmental Conservation Zones, Special Environmental Conservation Areas, Tourism Areas and Centres, Areas within the scope of Grassland Law in 1/100,000 Scaled Map in a Comprehensible Manner with Colours)

The assessment of the Efe-7 Geothermal Power Plant of the project area and its immediate vicinity carried out by observing the List of Sensitive Regions Annex-V to Environmental Impact Assessment Regulation is as follows.

1. Areas To Be Protected In Accordance With The Legislation Of Our Country

a) "National Parks", "Nature Parks", "Natural Monuments" and "Nature Reserve Areas" defined in Article 2 of the National Parks Law

Information on protected areas within the boundaries of Aydın province is given below.

National Parks (NP)

There are 40 National Parks in Turkey.

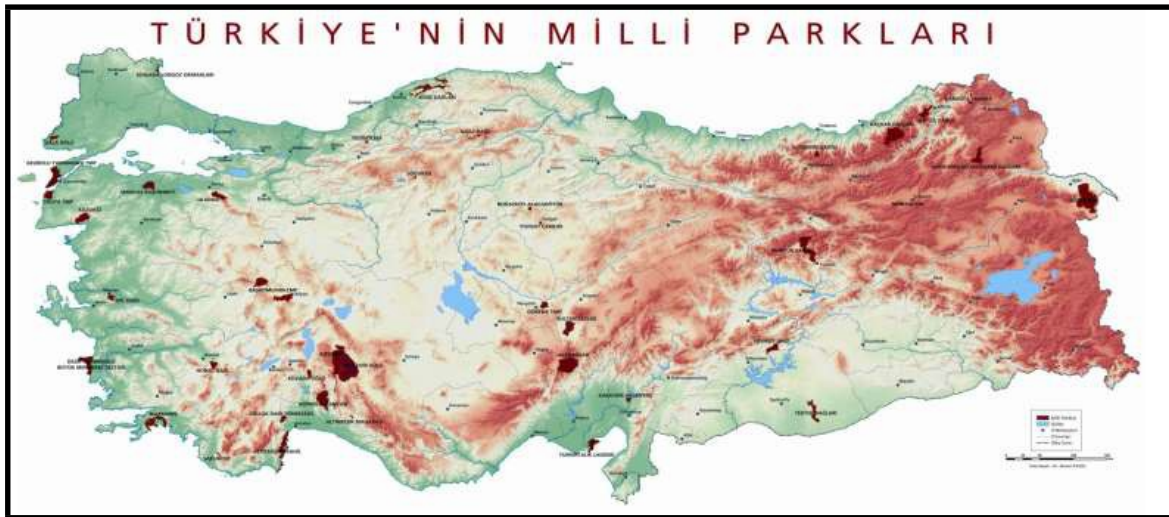


Figure 62. National Parks in Turkey

Source: <http://www.milliparklar.gov.tr>, January, 2017.

There is no national park in the immediate vicinity of the project area.

The only national park in Aydın province, where the Efe-7 GPP project is located, is Dilek Peninsula - Büyük Menderes D. National Park in the district of Kuşadası and its distance to the project area is nearly 37 km.

Table 39. National Parks in Aydın Province

PROVINCE	District	Name	Area (decare)	Year	Distance to the Project
Aydın	Kuşadası	Dilek P. - B. Menderes D. National	275,981.62	1996	37 km

Source: General Directorate of Nature Conservation and National Parks, <http://www.milliparklar.gov.tr/mp/mp.pdf>, January, 2017. Source: MAK 2016-2017.



Figure 63. The Satellite Image Showing the Project Area and The Distance of the National Park in Aydın Province to the Project Area

Natural Park (NP)

According to the resolutions of the Central Hunting Commission (MAK) 2016- 2017, there are be 4 nature parks within the boundaries of Aydın Province, where the project will be implemented. These parks are listed in the table below and whether they are affected negatively due to their distance to the project area is out of question.

Table 40. Nature Parks in Aydın Province

P R O V I N C E	District	Regional Directorate	Name	Area (decare)	Year	Distance to the Project Area
Aydın	Söke	4th Regional Directorate	Bafa Lake	118,420.73	1994	35 km
Aydın	Didim	4th Regional Directorate	Tavşanburnu	117.34	2011	59 km
Aydın	Çine	4th Regional Directorate	Şarlan	370.29	2014	54 km
Aydın	Karacasu	4th Regional Directorate	Çağlayan	380.43	2014	78 km

Source: General Directorate of Nature Conservation and National Parks,
<http://www.milliparklar.gov.tr/belge/tp.pdf>, January, 2017. Source: MAK 2016-2017

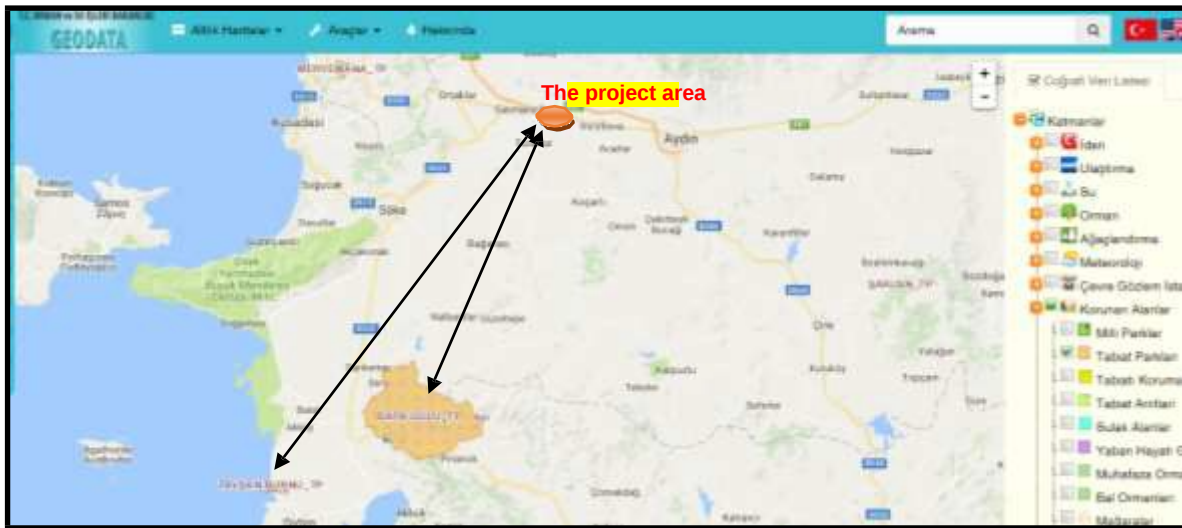


Figure 64. Map-1 Showing The Nature Parks in the Project Area and Aydın Province

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

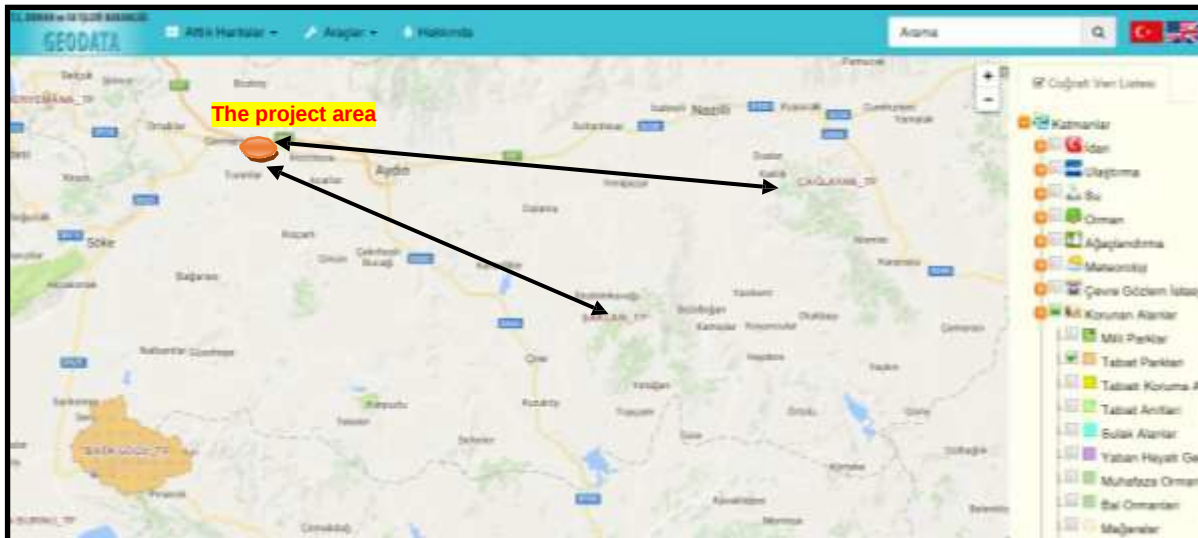


Figure 65. Map-2 Showing The Nature Parks in the Project Area and Aydın Province

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

Nature Reserve Area (NRA)

There is no nature reserve area within the boundaries of Aydın Province where the project will be implemented.

Natural Monument (NM)

There is no natural monument in Aydın province. Therefore, there is no natural monument in the project area and its immediate vicinity.

There are no "National Parks", "Nature Parks", "Natural Monuments" and "Nature Reserve Areas" in the project area.

b) "Wildlife Conservation Areas, Wildlife Rearing Areas and Wild Animal Settlement Areas" determined pursuant to Land Hunting Law,

There is no Wildlife Rearing Areas within the boundaries of Aydın Province, where the project will be implemented, according to the MAK resolutions. There is 1 wild animal settlement area in the province. The site is located within the boundaries of Çine and is approximately 30 km from the project area.

Çine District; East: The road from Dalama to Kasar village, connecting Kasar village to Altınova Village through Karanfiller Village **North:** Armutlu-Dalama Road, **West:** The road connecting Özeren Village to Hallaçlar Village, Hallaçlar Village to Armutlu Village through Yağcılar Village. **South:** The road connecting Altınova Village to Özeren Village.



Figure 66. Map Showing The YHYS (Wild Animal Settlement Area) in the Project Area and Aydın Province

Source: General Directorate of Nature Conservation and National Parks, <https://avlakharitalari.ormansu.gov.tr>, January, 2017.



Figure 67. Map Showing The YHYS (Wild Animal Settlement Area) in the Project Area and Aydın Province
Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

c) Areas defined as "Cultural Property", "Natural Assets", "Protected Area" and "Conservation Area" in the 1st, 2nd, 3rd and 5th sub-paragraphs of the article titled "Definitions" of the first paragraph of Article 3 of the Law on the Protection of Cultural and Natural Assets and determined and registered pursuant to the relevant provisions of the same Law and the Law dated 17/6/1987 and numbered 3386 (Law on Amendment of Some Articles of Protection Of Cultural And Natural Properties Law and Inclusion of Some Articles To This Law numbered 2863).

As shown in the 1/100,000 scaled Environmental Plan of the Aydın-Muğla-Denizli Planning Region given in Annex-2, there are no protected areas, conservation areas in the project area.

In addition, in the opinion of the Directorate of Conservation of Regional Cultural Assets given in Annex-23, it is stated that there is no registered protected area or structure in the Efe-7 Geothermal Power Plant project in terms of cultural assets regarding the Law No. 2863 on Protection of Cultural and Natural Property.

ç) Aquaculture and Reproduction Areas under the Fisheries Law

In the project area; there are no Aquaculture and Reproduction Areas under the Fisheries Law dated 22.3.1971 and numbered 1380.

d) Areas defined in articles 17, 18, 19 and 20 of the Water Pollution Control Regulation

The dam closest to the project area is İkizdere Dam, located at a distance of about 11 km to the northeast of the project area.

The project area does not exist in the buffer zone of the İkizdere Dam.

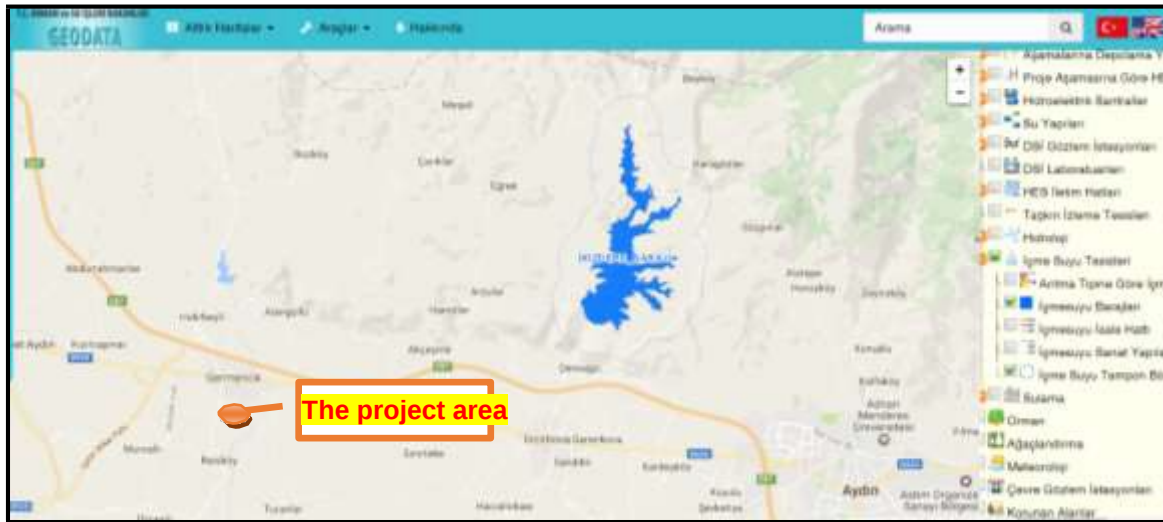


Figure 68. Map Showing The Project Area and Ikizdere Dam Buffer Zone

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.



Figure 69. The Satellite Image Showing the Project Area and Ikizdere Dam, Which Is The Nearest Dam

e) Areas defined in the Regulation on Air Quality Assessment and Management

There is no area within the scope of the title "Critical Pollution Areas" defined in the Article 49 of Cancelled Regulation on Protection of Air Quality published on the Official Gazette dated 02.11.1986 and numbered 19269 in the project area and its vicinity.

f) The areas identified and declared as "Special Environmental Protection Areas" by the Council of Ministers according to the Article 9 of the Environmental Law

There is no SEPA within the boundaries of Aydın province, where the Efe-7 GPP project is located.



Figure 70. SEPA Areas in Turkey

Source: General Directorate of Protection of Natural Assets-Special Environmental Protection Areas, January, 2017.

g) Areas under protection according to the Bosphorus Law

There is no area within the scope of the title "Area Under Protection" according to Bosphorus Law numbered 2960 and dated 18.11.1983 in the project area and its vicinity.

ğ) Places considered as forest areas in accordance with the Forest Law

The project subject planned on the area of 32,283,345 m² in Aydın Province, Germencik District, Mesudiye Neighbourhood, Seyrekkovalık Site lot 141, block number 121, 133, 119, 97, 102 and lot 245, block number 147 and the ownership of the area belongs to the investor company (See Annex-10).

There are no forest areas within the project area.

h) Areas under construction ban pursuant to the Coastal Law

There is no area within the scope of the title "Areas Under Construction Ban" pursuant to the Coastal Law numbered 3621 and dated 04.04.1990 in the project area and its vicinity.

ı) Areas specified in the Law on Improvement of Olive Cultivation and Grafting the Wild

Ones There are no olive groves within the scope of the Project area.

i) Areas specified in Pasture Law

The project area is not in the areas specified in the Pasture Law.

j) Areas specified in the Regulation on the Protection of Wetlands

There are 14 Ramsar Site in Turkey and there is no Ramsar Site in Aydın Province where the project will be implemented. Bafa Lake and Büyükenderes Delta are located as wetlands and they are not affected negatively due to their distance to the project area.



Figure 71. Map Showing The Wetlands in The Project Area and Aydın Province

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

2. Areas To Be Protected In Accordance With International Conventions Of Our Country

a) The Mediterranean Monk Seal and Reproduction Areas", I. and II. Protection Regions stated in the "Important Sea Turtle Reproduction Areas" under protection in accordance with the Convention on the Conservation of European Wildlife and Natural Habitats" (Bern Convention)

There are no areas in the project field and its vicinity specified in the Mediterranean Monk Seal and Reproduction Areas", I. and II. Protection Regions stated in the "Important Sea Turtle Reproduction Areas" under protection in accordance with the Convention on the Conservation of European Wildlife and Natural Habitats" (Berne Convention) which entered into force after being published in the Official Gazette No. 18318, dated 20.02.1984

b) Areas under protection pursuant to "Convention for Protection of the Mediterranean Sea against Pollution" (Barcelona Convention)

The project area has no relevance with the areas under protection pursuant to "Convention for Protection of the Mediterranean Sea against Pollution" (Barcelona Convention).

There are no areas identified as "Special Protection Area" in our country according to the Protocol Concerning the Protection of the Mediterranean Specially Protected Areas" which was published in the Official Gazette No. 19968, dated 23/10/1988, Areas included in the "Mediterranean Joint 100 Historical Sites of International Importance" published by the United Nations Environment Programme selected according to the Declaration of Genoa, dated 13/09/1985, Coastal Areas being living and nutrition environments of "Mediterranean Endangered Sea Species" included in Article 17 of the Declaration of Genoa in the project area or its vicinity.

i) Areas identified as "Special Protection Area" in our country according to the "Protocol Concerning the Protection of the Mediterranean Specially Protected Areas"

There are no areas identified as "Special Protection Area" in our country according to the "Protocol Concerning the Protection of the Mediterranean Specially Protected Areas", which was published in the Official Gazette No. 19968, dated 23/10/1988, in the project area.

ii) Areas included in the "Mediterranean Joint 100 Historical Sites of International Importance" published by the United Nations Environment Programme

There are no included in the “Mediterranean Joint 100 Historical Sites of International Importance” published by the United Nations Environment Programme selected according to the Declaration of Genoa, dated 13/09/1985.

ii) Coastal Areas being living and nutrition environments of “Mediterranean Endangered Sea Species” included in Article 17 of the Declaration of Genoa,

There are no areas identified as Coastal Areas being living and nutrition environments of “Mediterranean Endangered Sea Species” included in Article 17 of the Declaration of Genoa, in the project area and its vicinity.

c) Cultural, historical and natural areas given the status of “Cultural Heritage” and “Natural Heritage” taken under protection by the Ministry of Culture according to Article 1 and 2 of the "Convention for the Protection of World Cultural and Natural Heritage"

There is no protected area in the project area.

d) Areas under protection according to the “Especially Waterfowl Habitat Convention on the Conservation of Wetlands of International Importance" (RAMSAR Convention)

There is no Ramsar Area in Aydın Province.

There is no protected area in accordance with the Convention on the Protection of Wetlands of International Importance (RAMSAR Convention) in the project area.

d) European Landscape Convention

There is no area under the European Landscape Convention, which entered into force after being published in the Official Gazette dated 27.7.2003 and numbered 25181, in the project area and its immediate vicinity.

3. Areas required to be protected

a) In the Certified Environmental Plans, areas with the existing features determined to be protected and banned from construction (Natural conservation area, biogenetic reserve areas, geothermal fields and so on.)

The project area is in an agricultural area according to 1 / 100.000 scaled Aydın-Muğla-Denizli Region Environmental Plan. There are no areas identified as areas to be conserved and subject to construction ban in the project area.

b) Agricultural Lands Agricultural development areas, irrigated, irrigatable, areas with land use capability classes I, II, III and IV, areas depending on rainfall for agriculture classes I and II. and all specific areas of plantation crops,

When we look at the 1 / 25.000 scaled Land Assets Map prepared for the Efe-7 Geothermal Power Plant Project and presented in Annex-3, it is seen that the project area is located in an irrigated agricultural (S) area.

c) Wetlands: Wetlands either Natural or artificial, permanent or temporary, with static or running, fresh, brackish or salty water, including sea depths not exceeding six meters at the time of the low tide, all waters especially important as habitats for waterfowl species, swamps, reeds and turbaries and ecological wetland areas from the shore line towards the landside

There is no area in wetland status in the planned project area.

In order to prevent environmental pollution on the water surfaces during the works to be carried out within the scope of the project, the provisions of "Water Pollution Control Regulation" entered into force after being published in Official Gazette dated December 31, 2004 and numbered 25687, "Regulation on Amendment to the Water Pollution Control Regulation" entered into force after being published in Official Gazette dated February 13, 2008 and numbered 26786, "Fisheries Law" dated 22.03.1971 and numbered 1380 and "Fisheries Regulation" entered into force after being published in the Official Gazette dated March 10, 1995 and numbered 22223 shall be observed.

ç) Lakes, rivers, groundwater operation sites

There are no streams, dams, lakes and ponds in the project area.



Figure 72. Map Showing The Dams, Lakes, Ponds and Streams In The Project Area and Its Vicinity

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

d) The areas which are important for scientific researches and/or endangered or endangerable species and habitats of endemic species for our country, biosphere reserve, biotopes, biogenetic reserve areas, areas where geological and geomorphological formations with unique characteristics are found

There are no areas which are important for scientific researches and/or endangered or endangerable species and habitats of endemic species for our country, biosphere reserve, biotopes, biogenetic reserve areas, areas where geological and geomorphological formations with unique characteristics are found, in the project area and its vicinity.

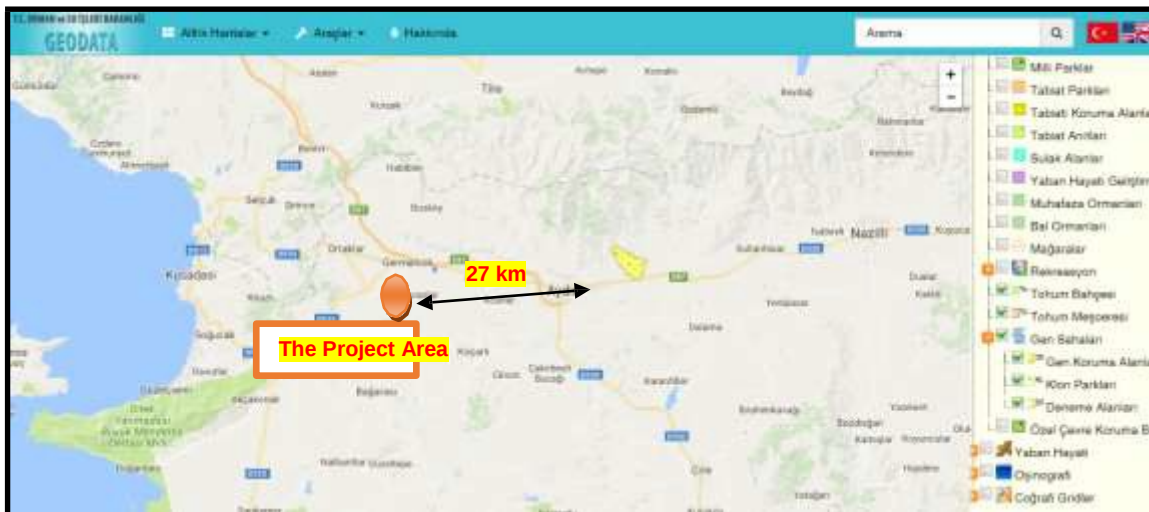


Figure 73. Map Showing The Gene Protection Areas and Seed Protection Areas In the Project Area and Its Vicinity

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

II.2.12. Flora and fauna (Species, Endemic, Especially Local Endemic Plant Species, Animal Species Living Naturally In The Area, Species Under Protection By National And International Regulations, Rare And Endangered Species And The Places They Are Found In The Area, Their Distribution In The Area, Quantities, Names And Population Of Game Animals And The Resolutions Of The Central Hunting Commission On Them, When, By Which Method (Use Of Literature-Current Resources, Observation, Etc.) And By Whom Each Species Are Determined Its status according to Collins Bird Guide, Türkiye'nin Önemli Kuş Alanları Book [Important Bird Areas of Turkey], Türkiye'nin Önemli Doğa Alanları Book [Important Natural Areas of Turkey], IUCN, Berne Convention, MAK Resolutions, How The Species Will Get Affected From The Project, Demonstration of Vegetation Types in the Project Area on a Map, Protection Measures to be Taken for the Living Creatures to be Affected from the Project and the Works (During Construction and Operation Stage), Implementation of Flora Works to be Made on the Land During the Vegetation Period and Specification of that Period, Performing Control For Flora Using the Turkish Plants Data Service (Tubives)

The flora and fauna studies of the EIA Report for the project planned to be implemented in the borders of Germencik District of Aydın Province were carried out by Biologist Tuğba BUDAKOĞLU in September (2016).

Flora

• IUCN Red List Categories

IUCN (The World Conservation Union: The International Union for Nature and Natural Resources) red list of species in danger of extinction is the most comprehensive global conservation inventory in the world for plant-animal species. IUCN Red List is maintained by the International Union for the Conservation of Natural Life and Natural Resources. IUCN Red List is created by using objective criterion and by evaluating the extinction risk of thousands of species and subspecies. This criterion relates to all species and to all regions of the world. The classification of flora and fauna species according to the IUCN risk classes started to be realized in European countries since the 1970s. IUCN categories were examined in 9 groups. Extinction rate, population size, geographical distribution areas and population and distribution degree criteria are taken into consideration.

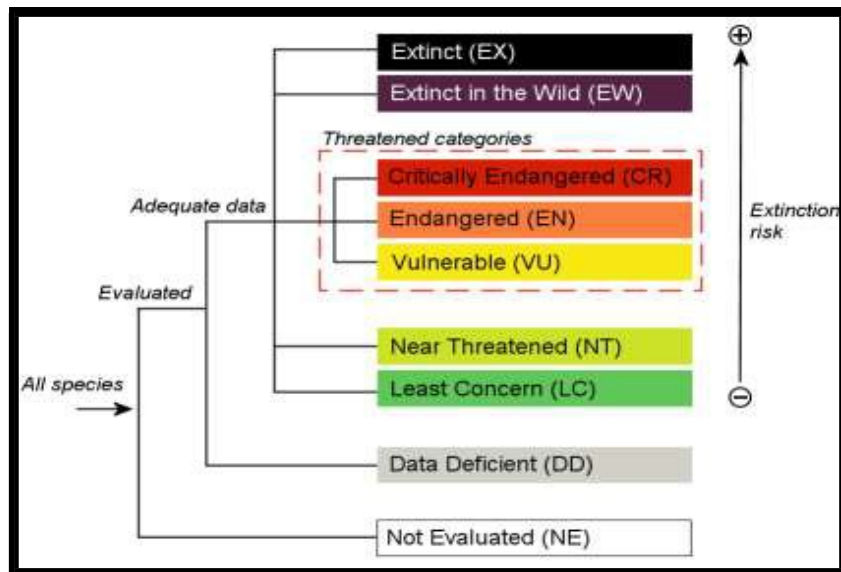


Figure 74. IUCN Red List Categories
Source: www.iucnredlist.org

Table 41. IUCN RED List Categories and Turkish Equivalents

Category	Turkish Equivalent
Adequate data	Yeterli data mevcut
Evaluated	Değerlendirmeye alınmış
Not Evaluated	Değerlendirmeye alınmamış
Data Deficient	Yeterli data mevcut değil(data eksik)
Extinct	Türü tamamen yok olmuş, nesli tükenmiş tür
Extinct in the Wild	Vahşi doğada nesli tükenmiş tür
Critically Endangered	Önemli derecede yok olma tehlikesi olan tür
Endangered	Yok olma tehlikesi olan tür
Vulnerable	Koruma önlemi alınmazsa ileride yok olma tehlikesi olan tür
Near Threatened	Neredeyse tehdit altında
Least Concern	En az kaygılanılan tür

Table 42. Red Data Book Categories According to Prof. Dr. Ali Demirsoy (1996)

Category	Abbrevia	Turkish Equivalent
Endangered	E	Tehlikede
Extinct	Ex	Soyu tükenmiş
Indeterminate	I	Bilinmiyor
Insufficiently known	K	Yetersiz bilinenler
Not threatened	Nt	Takson henüz tehlike altında değil
Out of danger	O	Takson tehlike dışı
Rare	R	Nadir
Vulnerable	V	Zarar görebilir

• BERNE CONVENTION

The Berne Convention is an agreement on the conservation of wildlife and habitats. The protected species under the convention are indicated as three separate lists. Accordingly, these lists cover the following;

List of Annex-I: It covers the species of flora which are under strict protection. Annex-II List: It covers the species of fauna which are under strict protection. Annex III List: covers protected fauna species.

• HUNTING PERIOD CENTRAL HUNTING COMMISSION RESOLUTIONS (MAK)

"2016-2017 Hunting Period Central Hunting Commission Resolutions" lists which entered into force after being published in the Official Gazette by the Turkish Ministry of Forestry and Water Affairs General Directorate of Nature Conservation and National Parks are processed in the related tables.

FLORA

The exploitation area is in the C1 square according to the Grid System. The following were used while creating the Flora and fauna part,

- Davis's "Flora of Turkey and East Aegean Islands" work,
- Literature studies published in relation to Flora of Turkey,
- TÜBİTES Plant Data Service,
- The prepared data were used in preparation of many projects in the region.

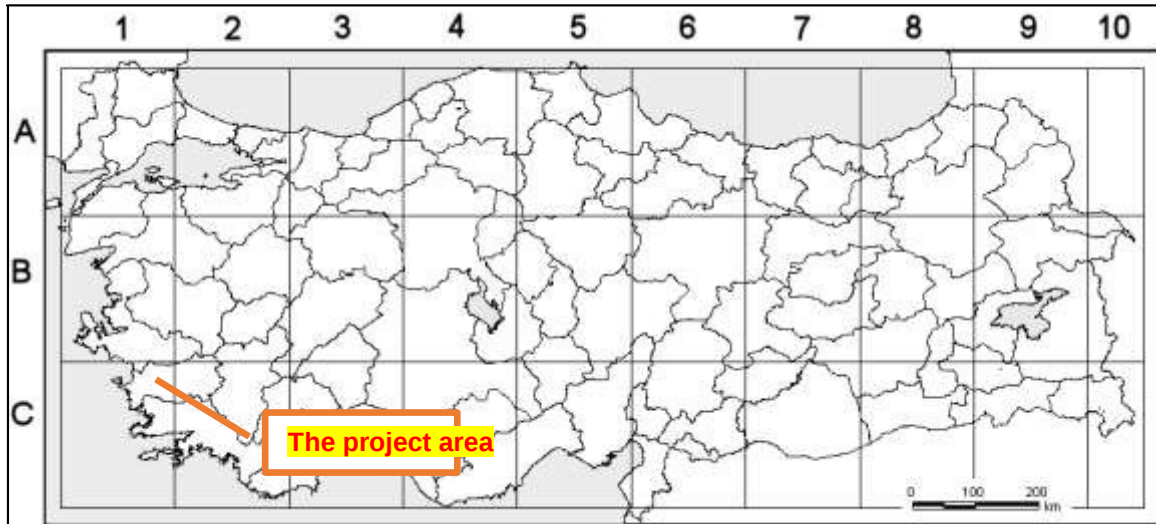


Figure 75. P. H Davis Grid System

- Distribution of Flora Species by Phytogeographical Region

When examined in terms of the plant geography of our country, completely it is located in the Holarctic Kingdom (Palearctic and Nearctic realm). 3 floristic realms of Holarctic Kingdom are united in our country. These are:

- Euro-Siberian Region
- Mediterranean Region
- Iran-Turan Region

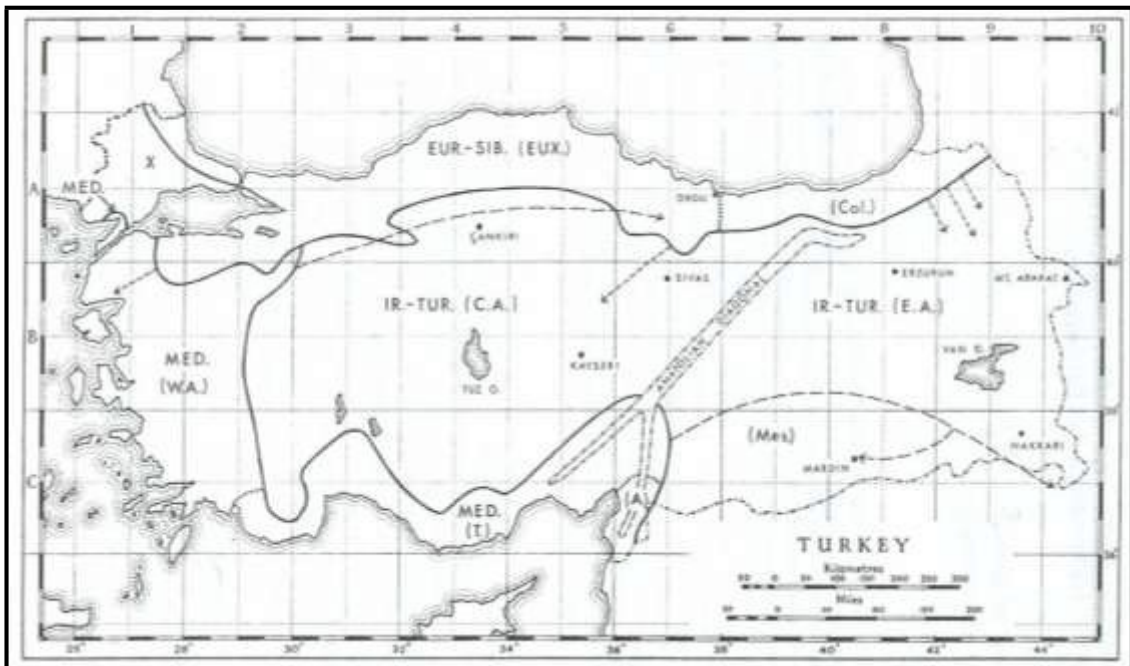


Figure 76. Turkey's Phytogeographical Regions

Source: PH Davis' map



Figure 77. General View of Planned Project Area-Lot 245 Block 147

The planned project is located in Aydın Province. Aydın Province is located in MED. (WA) /Mediterranean Region (Western Anatolia Region) Phytogeographical region.

The exploitation area is located in the Mediterranean Phytogeographical Region. A vegetation consisting of xerophilous, evergreen, leafy trees and bushes constitutes the Mediterranean vegetation.

The borders of the Mediterranean Phytogeographical Region cannot be clearly and precisely drawn as in the Euro-Siberian (Black sea) Phytogeographical Region. The most important reason for this is that the flora regions can cross the boundaries of each other. There are important floristic relations especially between the Mediterranean Phytogeographical Region and Iran-Turan Phytogeographical Region.

The Mediterranean Phytogeographical Region starts from the Gallipoli peninsula in the southern part of Thrace. It makes its main and wide spread in the coastal parts of Western and Southern Anatolia, and it also includes Amanos Mountains in the east. Apart from this general spread, it is spread throughout the Black Sea Region in small parts. However, since the Mediterranean flora along the Black Sea, which is observed as intermittent in parts, has different characteristics from maqui, the real Mediterranean vegetation, it is called Black sea maquis.

The vegetation of the Aegean Region shows a rich variety. It contains distinctive groups of semi-alpine plant populations in the peaks of high mountains such as Kazdagi, Bozdag, Muratdagi, Nif mountain, Spil Mountain, Akdag, Sandras Mountain, Honaz Mountain to dense, brutia pine and black pine forests, evergreen maquis and dry phrygana.

The vegetation in the region is mostly xerophilous due to the hot and dry summer period. For this reason, evergreen plants and needle-leaved plants are always found in the region with thick and bright leaves because of high light and heat demand. The most important feature of the plants in this region is that they are resistant to dry season. However, the plants of the Mediterranean Region, are not drought-loving like cacti, but are drought-tolerant. As a matter of fact, trees and small trees, especially brutia pine trees (*Pinus brutia*) develop very rapidly in areas where ground water is high. As a matter of fact, in such environments, the amount of biomass growth or growth in brutia pine trees is nearly the same with the trees in the equatorial forests. The maquis formation in the Mediterranean phytogeography region starts from the Aegean coasts and enters into the Central Western Anatolia, especially through tectonic depressions. The areas where the brutia pine forests were destroyed in the region are mostly covered with maquis. However, there is a significant change in species. In general, cermes oak (*Quercus coccifera*) is common on the metamorphic schists where the natural balance is deteriorated by erosion of the soil cover and dry with respect to regional conditions. In contrast, laurel (*Laurus nobilis*), Sandalwood (*Arbutus andrachne*), arbutus (*Arbutus unedo*), myrtle (*Mrytus communis*), woadwaxen (*Spartium junceum*) are prevalent in humid environments and karst areas.

Phrygana or garigue is a collection of plants with knee-length shrubs, which are caused by the destruction of the maquis or excessive grazing of the maquis. Phrygana, a small hard-skinned leaved, mostly needled, xerophytic and aromatic small bushes. This cover is spread up to 0-500 m. height from the seal level. The most important feature of garigues is yellowing in the summer period and the appearance of the environment becomes completely yellow. Essentially, the garigues are becoming more common in areas where the natural environment balance is severely impaired, the soil is completely eroded, and the main material appears. The first such vegetation in such areas is generally garigue units. In the Mediterranean Plant Geography Region, the areas where the natural environment is extremely damaged are covered by garigues and they take root as if they are stabile vegetation. In addition, since garigue units have the ability to spread fast, they come to the abandoned fields and destroyed brutia pine forest and maquis areas as a pioneer plant.

Plants such as *Platanus orientalis* and *Nerium oleander* are common in dry creek beds and flood zones. The main crops of the Aegean Region are tobacco, cotton, potato, rice, different kinds of vegetables, grapes, citrus fruits, cherries, figs and peaches. Other fruit trees in the region are pomegranates, apples, pears, almonds and mulberries.

Various abbreviations have been used to indicate the phytogeographical regions of the taxa, which are highly probable to be found in the exploitation area and its vicinity due to their habitat characteristics. Accordingly; the following abbreviations are made. Eur.-Sib. Ele. (European-Siberian Element), E. Med. Ele. (Eastern Mediterranean Element), Med. Ele. (Mediterranean Element) and Ir.-Tur. Ele. (Iran-Turan Element). For widespread ones or those whose phytogeographical region is not certainly known are indicated as (-).

Status of Flora Species in terms of Endemism and Hazard Classes

There are no plant species which is under threat of extinction and required to be protected according to Convention on the Conservation of European Wildlife and Natural Habitats" (Berne Convention) Annex-I list within the exploitation area and its vicinity. There are no endemic species in the exploitation area and its vicinity.

Table 43. Types of Flora Which are Highly Probable to be Found in the Project Area and its Vicinity

Family	Species name in Latin	English name	HABITAT	Altitude (m)	Distribution in Turkey	P.R (Phytogeographical)	Abundance	IUCN	BERN	ENDEMISM				Source
										L	R	C	N	
ARACEAE	<i>Dracunculus vulgaris</i>	Dragon lily	Field edges, ruins, destroyed habitats	30-475	NW, W. and C. Anatolia	Mediterranean	3	-	-				X	L
	<i>Biarum tenuifolium</i>		Limestone slopes, cliffs, rocky maquis, road edges, Fucus meyvaorchards (?)	30-600	SW. Anatolia	Mediterranean	2	-	-				X	L
VITACEAE	<i>Vitis vinifera</i>	Common Grape Vine	Cultivation Areas (Vineyard, garden, etc.)		Turkey	-	3	-	-				X	L, O
UMBELLIFERAE	<i>Ammi visnaga</i>	Toothpick-plant,	Fields and plains	0-700	Thrace, Outside and E. (S. end) Anatolia	Mediterranean	3	-	-				X	L
	<i>Thapsia garganica</i>		Rocky slopes stony road edges	0-550	W. Turkey	Mediterranean	2	-	-				X	L
BORAGINACEAE	<i>Alkana tinctoria ssp.tinctoria</i>		Cultivation Areas (Vineyard, garden, etc.)	0-800 m		Mediterranean	2	-	-				X	L
	<i>Buglossoides arvensis</i>		Limestone slopes, field edges, grain fields, rocky slopes, fallow fields	0-2500	Turkey	-	3	-	-				X	L
BRASSICACEAE	<i>Raphanus raphanistrum</i>	Radish	Fallow field, cultivated field, sandy field	0-400	Outer Anatolia	-	4	-	-				X	L, O
CARYOPHYLLACEAE	<i>Silene colorata</i>	Catchfly	Coasts, fields, rocky slopes, dunes	0-800	W., S. and SE. Anatolia	-	3	-	-				X	L
CISTACEAE	<i>Cistus salviifolius</i>		Coast hill calcareous maquis, garrigue	0-500	N. and W. Turkey, S. Anatolia	-	2	-	-				X	L, O
COMPOSITAE	<i>Anthemis auriculata</i>		Field, limestone slope, Pinus forest	0-400	W. Turkey	Mediterranean	2	-	-				X	L
	<i>Notobasis syriaca</i>		Limestone rocky slope, fallow field, edges, roadside	0-850	NW. Turkey, W., S. and E. Anatolia (G. end)	Mediterranean	3	-	-				X	L
	<i>Anthemis pseudocotula</i>		Stony slope, field, roadside	0-1500	Thrace, W., S. and E. (S. end) Anatolia	-	3	-	-				X	L
	<i>Leontodon tuberosus</i>		Forest, dune, fallow field	0-1200	Outer Anatolia	Mediterranean	2	-	-				X	L
SALICACEAE	<i>Salix alba</i>	White willow	Lake edges, creek and stream edges	0-2000	Turkey	Europe-Siberia	2	LC	-				X	L, O
FAGACEAE	<i>Quercus aucherii</i>	Aegean Oak	Maquis limestone slopes	0-450	SW. Anatolia	Mediterranean	3	-	-				X	L, O
GERANIACEAE	<i>Geranium purpureum</i>		Rocky or shaded places, gravelled places, coasts, fields	0-2200	N., W., S. Anatolia	-	2	-	-				X	L
	<i>Erodium ciconium</i>	Stork's bill	Fields, meadows, steppe	0-1500	W., N., C., E. S. Anatolia	-	3	-	-				X	L, O
GRAMINEAE	<i>Bromus hordeaceus ssp.hordeaceus</i>		Fields and roadsides	0-700	N. Turkey, W. and C. Anatolia	-	3	-	-				X	L
	<i>Bromus rigidus</i>		Quercus coccifera phrygana, dry grasslands, shaly slopes, barren	0-1000	Turkey (dispersed)	-	3	-	-				X	L

Family	Species name in Latin	English name	HABITAT	Altitude (m)	Distribution in Turkey	P.R (Phytogeog.)	Abundance	IUCN	BERN	ENDEMISM				Source
										L	R	C	N	
			places, cultivated land											
	<i>Lolium rigidum</i> <i>var.rigidum</i>		Rocks, steppe, pastures, fallow land, vineyards, sands, roadside	0-1850	Outer Anatolia and E. Anatolia	-	2	-	-				X	L
GUTTIFERAE	<i>Hypericum empetrifolium</i>	yellow purée	Oak and juniper maquis, brutia pine groves and limestone rocks	0-800	W. and S. Anatolia	Mediterranean	2	-	-				X	L
LABIATAE	<i>Lamium moschatum</i> <i>var.moschatum</i>		Rocks, fallow fields, roadside	0-500	W. and S. Anatolia	Mediterranean	3	-	-				X	L, O
	<i>Marrubium peregrinum</i>		Roadside, barren places	0-400	Thrace, W., NW. and adjacent C. Anatolia	-	2	-	-				X	L, O
	<i>Salvia virgata</i>	Wand sage	Bushwood, meadows, fallow fields, roadside	0-2300	Turkey	Iran-Turan	3	-	-				X	L
	<i>Mentha suaveolens</i>	Apple mint	Wet places, frequently drying in summer	0-400	W. Turkey	Mediterranean	2	-	-				X	L
	<i>Satureja thymbra</i>	Pink Savory	Dry bushes, calcareous phrygana	0-400	W. Turkey, S. Anatolia	Mediterranean	2	-	-				X	L
LAURACEAE	<i>Laurus nobilis</i>	Bay laurel	Shoreline maquis, dense bushes mixed with myrtus, Phillyrea ve Erica arborea, Pinus brutia	0-1200	Outer Anatolia	Mediterranean	2	-	-				X	L, O
CONVOLVULACEAE	<i>Convolvulus arvensis</i>	Field bindweed	Sandy steppe, fallow fields, on the edges of ditches, rivers and lakes	0-3050	Turkey	-	3	-	-				X	L
LEGUMINOSAE	<i>Ononis pubescens</i>		Maquis, pine groves, fallow fields, vineyards	0-700	NW. Turkey, W. and E. (S. end) Anatolia	Mediterranean	3	-	-				X	L
	<i>Trifolium spumosum</i>	Clover	Wet fields, grassy places, road edges	0-650	NW, S., W. and E. (S. end) Anatolia	Mediterranean	3	-	-				X	L
	<i>Trigonella gladiata</i>		Phrygana, cultivated fields, vineyards	0-800	NW. Turkey, W., S. and C. Anatolia	Mediterranean	4	-	-				X	L
	<i>Medicago granadensis</i>		Empty places, fruit gardens	0-700	NW. Turkey, W. and S. Anatolia	Mediterranean	3	-	-				X	L
	<i>Anthyllis hermanniae</i>		Maquis, phrygana	0-400	NW. Turkey and W. Anatolia	Mediterranean	4	-	-				X	L
	<i>Hippocrepis ciliata</i>		Outdoor grounds	0-800	Thrace, Outer and neighboring C. Anatolia	Mediterranean	3	-	-				X	L
	<i>Onobrychis aequidentata</i>		Rocky slopes, oak shrubs and garrigue	30-850	NW. Turkey, W., S. and SE. Anatolia	Mediterranean	2	-	-				X	L
LILIACEAE	<i>Ornithogalum nutans</i>		Slopes, countryside, meadows, roadsides	0-1950	W., C. and S. Anatolia	-	2	-	-				X	L
	<i>Asphodelus aestivus</i>	Asphodel	Countryside	0-900	W. and S. Anatolia	Mediterranean	2	-	-				X	L

Family	Species name in Latin	English name	HABITAT	Altitude (m)	Distribution in Turkey	P,R (Phytoge)	Abundance	IUCN	BERN	ENDEMISM				Source
										L	R	C	N	
	<i>Linum strictum</i> <i>var.strictum</i>		Rocky slopes, fallow fields	0-900	W. and N. Anatolia	-	3	-	-				X	L
MORACEAE	<i>Ficus carica</i>		Outdoor areas, mixed forests, stony slopes, valleys, rock caverns	20-1770	Turkey	-	3	-	-				X	L, O
	<i>Morus alba</i>	White Mulberry	Cultivation	-	Turkey	-	2	-	-				X	L, O
PAPAVERACEAE	<i>Fumaria densiflora</i>		Cultivated field	0-500	Thrace, W., S. and C. Anatolia	-	4	-	-				X	L, O
	<i>Papaver rhoeas</i>		Field, empty place	0-1400	Turkey	-	2	-	-				X	L
POLYGONACEAE	<i>Rumex bucephalophorus</i>		Fields, dunes	0-150	N., W. and S. Anatolia	Mediterranean	3	-	-				X	L
PINACEAE	<i>Pinus brutia</i>		Forest	0-1200	Outer Anatolia, Thrace	Mediterranean	2	LC	-				X	L
RANUNCULACEAE	<i>Delphinium staphisagria</i>	Lice-bane	Groves, empty place, calcareous rock	0-250	W. and S. Anatolia	Mediterranean	3	-	-				X	L, O
	<i>Ranunculus muricatus</i>		Humid field, muddy roadside, inside the ditch	0-800	Outer Anatolia	Mediterranean	3	-	-				X	L, O
UMBELLIFERAE	<i>Torilis leptophylla</i>		Slopes, fields, barren places	0-2500	Turkey	-	2	-	-				X	L
	<i>Smyrniurn rotundifolium</i>	Round-Leaved Alexanders	Dry coasts, outdoor habitats	0-600	W. Anatolia	Mediterranean	2	-	-				X	L, O
	<i>Hippomarathrum cristatum</i>	Sicilian Cachrys	Phrygana, cultivated fields	0-300	W. Turkey	Mediterranean	3	-	-				X	L
Abundance: 1. Very Rare 2. Nadir 3. Relatively abundant 4. Very abundant 5. Creating a Pure Population			Source: L: Literature O: Observation			Endemism: L: Local Endemic R: Regional Endemic W: Widespread Endemic N: Non-Endemic								
SOURCE: http://turkherb.ibu.edu.tr web (Turkey Plant Data Service - TÜBİVES) BAYTOP, T. 1994, Türkçe Bitki Adları Sözlüğü [Turkish Plant Names Dictionary], T.D.K. Basımevi, Ankara. DAVIS, P.H. 1965–1985, Flora of Turkey and East Aegean Islands, Vol. 1–9, Edinburgh UNIVERSITY Press, Edinburgh. EKİM, T. et al. 2000, Türkiye Bitkileri Kırmızı Kitabı [The Red Book Of Turkish Plants], T.T.K. Derneği, Ankara. GÜNER, A. et al. 2000, Flora of Turkey and East Aegean Islands, (Supplement 2), Vol. 11, Edinburg University Press, Edinburgh.														

Fauna

The fauna species show seasonal changes, and since determining the fauna inventory of an area may take several years the species given in the fauna lists are created by considering observations and hearsay of the locals, the biotope characteristics of the region, the existing areas of spread and the applicable biogeography rules in addition to field survey. Fauna lists include also the species which are not observed during the field study but have been revealed by literature surveys.

Fauna species located in the exploitation area and its vicinity and those which are possible to be found due to habitat characteristics are given in Table.44 for the amphibious species, in Table.45 for the species of reptiles, in Table.46 for the bird species and in Table.47 for the mammalian species.

In the tables related to the Fauna, each species' family is stated in terms of English name, habitat, IUCN category, Red Data Book Category, Berne Convention Annex-II and Annex-III lists, MAK resolutions Annex-I and Annex-II lists. For the species not included in the Berne Convention and MAK Resolutions, a sign (-) is placed.

Moreover, "2016-2017 Hunting Period Central Hunting Commission Resolutions" lists which entered into force after being published in the Official Gazette by the Turkish Ministry of Environment and Forestry General Directorate of Nature Conservation and National Parks are processed in the related tables.

➤ *Amphibians*

2 of the 4 amphibian species found on the project area route and its vicinity and those possible to be found due to habitat characteristics are included in the Bern Annex-2 list. 2 species are in the Bern Annex-3 list.

All amphibian species are in the "LC" category 2016-3 in the IUCN Red List Categories List.

None of the amphibian species is included in the latest "2016-2017 Hunting Period Central Hunting Commission Resolutions" lists which entered into force after being published in the Official Gazette by the Turkish Ministry of Forestry and Water Affairs General Directorate of Nature Conservation and National Parks.

Extinction of the amphibian species located on route to the exploitation area and its vicinity is out of question.

➤ *Reptiles*

6 of the 11 reptile species found in the project area and its vicinity and those possible to be found due to habitat characteristics are included in the Bern Annex-3, 5 of them are included in the Bern Annex-2 list.

5 species from Reptile species in the 2016-3 IUCN Red List Categories List are in the "LC" category, 1 species is in "VU" (Vulnerable to extinction if no protection measures are taken) category, 1 species in in NT (Near threatened) category. The remaining 4 reptile types are not included in the 2016-2 IUCN Red List Categories List.

None of the reptile species is included in the latest "2016-2017 Hunting Period Central Hunting Commission Resolutions" lists which entered into force after being published in the Official Gazette by the Turkish Ministry of Forestry and Water Affairs General Directorate of Nature Conservation and National Parks.

Extinction of the reptile species located on route to the exploitation area and its vicinity is out of question.

➤ *Birds*

20 of the 37 reptile species found on the project area route and its vicinity and those possible to be found due to habitat characteristics are included in the Bern Annex-2, 11 of them are included in the Bern Annex-3 list. The remaining 6 species are not included in the Berne Convention.

35 species from bird species in the 2016-3 IUCN Red List Categories List are in the "LC" category, 1 species is in "VU" (Vulnerable to extinction if no protection measures are taken) category, 1 species in in NT (Near threatened) category.

According to the latest "2016-2017 Hunting Period Central Hunting Commission Resolutions" lists which entered into force after being published in the Official Gazette by the Turkish Ministry of Forestry and Water Affairs General Directorate of Nature Conservation and National Parks, 6 bird species are included in the Annex-I, which is list of "Those Under Protection by the Ministry of Forestry and Water Affairs"; 10 bird species are included in the Annex-II, which is "Game Animals Which Are Permitted to be Hunted For A Specific Period by the Central Hunting Committee".

Extinction of the bird species located in the exploitation area and its vicinity is out of question.

➤ *Mammals*

1 of the 8 mammal species found on the project area route and its vicinity and those possible to be found due to habitat characteristics are included in the Bern Annex-III list. The remaining 7 mammal species are not included in the Berne Convention.

7 of the mammal species are in the category of "LC" category and 1 of them is in the "DD" category of the 2016-3 IUCN Red List Categories. 7 species included in the IUCN Red List are in the "nt" category according to the Red Book Data Categories determined by Demirsoy (1996). Species in the "nt" category are very widespread and abundant in Turkey and they are not under threat of extinction.

According to the latest "2016-2017 Hunting Period Central Hunting Commission Resolutions" lists which entered into force after being published in the Official Gazette by the Turkish Ministry of Forestry and Water Affairs General Directorate of Nature Conservation and National Parks, 1 mammal species is included in the Annex-I; 2 mammal species are included in the Annex-II, which is "Game Animals Which Are Permitted to be Hunted For A Specific Period by the Central Hunting Committee".

The exploitation area is not included in the Area for Rearing and Breeding Wild Life, National Parks, Nature Reserve Areas, Nature Parks, Forbidden Area For Hunting determined by the Turkish Ministry of Environment and Forestry General Directorate of Nature Conservation and National Parks.

Table 44. Amphibian Species Which Are Highly Probable To Be Found In The Project Area And Its Impact Area

FAMILY	NAME IN LATIN	ENGLISH NAME	HABITAT	ENDEMISM	IUCN	RDB	BERN	SOURCE
PELOBATIDAE	<i>Pelobates syriacus</i>	Eastern Spadefoot	Under the rocks and under soil	-	LC	nt	Annex-III	L
HYLIDAE	<i>Hyla arborea arborea</i>	European Tree Frog	On the trees and bushes	-	LC	nt	Annex-III	L
BUFONIDAE	<i>Bufo bufo</i>	Toad	Under the rocks and under soil	-	LC	nt	Annex-III	L
	<i>Bufo viridis</i>	European green toad	Under the rocks and under soil	-	LC	nt	Annex II	L

Source: -Demirsoy, A., 1996, Türkiye Omurgalıları "Amfibiler" [Vertebrates in Turkey "Amphibians"], Ministry of Environment General Directorate of Environmental Protection, Project No: 90-K-1000-90. Ankara.

-Turkish Herptil, <http://www.turkherptil.org>

-O: Observation L: Literature

Table 45. Reptile Species Which Are Highly Probable To Be Found In The Project Area And Its Impact Area

FAMILY	NAME IN LATIN	ENGLISH NAME	HABITAT	ENDEMISM	RDB	IUCN	BERN	Population	MAK	SOURCE
TESTUDINIDAE	<i>Testudo graeca</i>	Tortoise	Sandy, stony dry land	-	nt	VU	Annex II	2	-	L
GEKKONIDAE	<i>Hemidactylus turcicus</i>	terrestrial house gecko	House and ruins, rock crevices, under the stones	-	nt	LC	Annex-III	3	-	L
AGAMIDAE	<i>Laudaki (=Agama) stellio</i>	Roughtail Rock Agama	Stony and rocky places	-	nt	-	Annex II	1	-	L
SCINCIDAE	<i>Ablepharus kitaibelii</i>	Juniper Skink	Trees and under the stones	-	nt	LC	Annex II	2	-	L
	<i>Mabuya (Trachylepis) aurata</i>	Golden Grass Mabuya	Stony areas with few plants	-	nt	LC	Annex-III	2	-	L
ANGUINIDAE	<i>Ophisaurus apodus thracicus</i>	European Glass Lizard	Stony areas with poor vegetation	-	nt	-	Annex II	2	-	L
BOIDAE	<i>Eryx jaculus</i>	Sand Boa	Sandy and stony areas in arid areas	-	nt	-	Annex-III	3	-	L
TYPLOPIDAE	<i>Typlos vermicularis</i>	Blind snake	In moist soil and stones	-	nt	-	Annex-III	3	-	L, O
COLUBRIDAE	<i>Eirenis modestus</i>	Anatolian Dwarf Racer	In stony grounds	-	nt	LC	Annex-III	2	-	L
	<i>Elaphe quatuorlineata saoromates</i>	Blotched Ratsnake	Trees, shrubs and stony fields, field and garden	-	nt	NT	Annex II	2	-	L
	<i>Coluber caspius</i>	Caspian Whipsnake	Field, swamp and stony creek edges	-	nt	LC	Annex-III	2	-	L

Source: The IUCN Red List Of Threatened Species 2016.3, <http://www.iucnredlist.org/>

Source: Demirsoy, A., 1997, Omurgalıları "Sürüngenler, Kuşlar ve Memeliler" [Vertebrates "Reptiles, Birds and Mammals"] Meteksan A.Ş., Ankara.

Source: Demirsoy, A., 1996, Türkiye Omurgalıları "Sürüngenler" [Vertebrates in Turkey "Amphibians"], Ministry of Environment General Directorate of Environmental Protection, Project No: 90-K-1000-90. Ankara. Source: MAK = Turkish Ministry of Forestry and Water Affairs "2016-2017 Hunting Period Central Hunting Commission Resolutions"

Source: <http://www.turkherptil.org/>

-O: Observation L: Literature

Table 46. Bird Species Which Are Highly Probable To Be Found In The Project Area And Its Impact Area

FAMILY	NAME IN LATIN	TURKISH NAME	ENGLISH NAME	HABITAT	STATUS	RDB	IUCN	BERN	MAK	SOURCE
SYLVIDAE	<i>Sylvia hortensis</i>	Kara Yüzlü Ötleğen	Orphean Warbler	Trees and shrubs, gardens, plains	G	A.2	LC	ANNEX-II	-	L
ALAUDIDAE	<i>Alauda arvensis</i>	Tarlakuşu	Eurasien Sky Lark	Field, open fields, woodland and mountainous areas	Y	A.4	LC	ANNEX-III	ANNEX-I	L
	<i>Melanocorypha leucoptera</i>	Akkanat Tarlakuşu	White-winged Lark	Settlements and fields	G	A.1.2	LC	ANNEX-II	-	L
HIRUNDINIDAE	<i>Hirundo rustica</i>	Kır kırlangıcı	Barn Swallow	Human settlements	G	A.5	LC	ANNEX-II	-	L
	<i>Delichon urbicum</i>	Pencere kırlangıcı	Northern House Martin	Settlements and cliffs	G	A.3	LC	ANNEX-II	-	L
PHASIANIDAE	<i>Alectoris graeca</i>	Taşkekligi	Rock Partridge	Stony and rocky places	Y	A.1.2	NT	ANNEX-III	-	L
	<i>Coturnix</i>	Bıldırcın	Common Quail	Cultivated fields, meadows and steppes	Y	A.3	LC	ANNEX-III	ANNEX - II	L
TURDIDAE	<i>Erithacus rubecula</i>	Kızılgerdan	European Robin	Wooded areas, parks and gardens	Y	A.3	LC	ANNEX-II	-	L
	<i>Luscinia megarhynchos</i>	Bülbül	Common Nightingale	Wooded areas, park and cemeteries	G	A.2	LC	ANNEX-II	-	L
	<i>Turdus pilaris</i>	Ardıç	Fieldfare	Woodland and meadow fields	B.2	K	LC	ANNEX-III	ANNEX-I	L
	<i>Turdus merula</i>	Karatavuk	Eurasien Blackbird	Wooded areas and gardens	Y	A.3	LC	ANNEX-III	ANNEX-II	L
COLUMBIDAE	<i>Columba palumbus</i>	Tahtalı Güvercin	Common Wood-Pigeon	Residential areas and wooded areas	Y	A.4	LC	-	ANNEX-II	L
	<i>Streptopelia turtur</i>	Üveyik	Euroasien Turtle Dove	Settlements and agricultural areas	G	A.3.1	VU	ANNEX-III	ANNEX-II	L
CHARADRIIDAE	<i>Scolopax rusticola</i>	Çulluk	Euroasien Woodcock	Wooded areas	K	B.3	LC	ANNEX-III	ANNEX-II	L
FALCONIDAE	<i>Falco tinnunculus</i>	Kerkenez	Common Kestrel	Settlements and forest areas	Y	A.2	LC	ANNEX-II	-	L
	<i>Falco peregrinus</i>	Gezginci Doğan	Peregrine Falcon	In forest areas and in open fields	Y	A.1.2	LC	ANNEX-II	-	L
ACCIPITRIDAE	<i>Accipiter nisus</i>	Atmaca	Eurasian Sparrowhawk	Sparse woodlands, wooded farmlands, and even gardens in settlements	Y	A.3	LC	ANNEX-III	-	L
	<i>Buteo</i>	Şahin	Common Buzzard	Forest areas, fields and meadows	Y	A.3	LC	ANNEX-II	-	L, O
	<i>Buteo rufinus</i>	Kızıl Şahin	Long-legged Buzzard	Deforested plains, mountains and steppes	Y	A.3	LC	ANNEX-II	-	L, O
	<i>Aquila chrysaetos</i>	Kaya Kartalı	Golden Eagle	High mountains and cliffs	Y	A.1.2	LC	ANNEX-II	-	L
STRIGIDAE	<i>Asio otus</i>	Kulaklı Orman Baykuşu	Long-eared Owl	Wooded areas	Y	A.2	LC	ANNEX-II	-	L
	<i>Strix aluco</i>	Alaca Baykuş	Tawny Owl	Lighted forests, parks and gardens	Y	A.2	LC	ANNEX-II	-	L
LANIIDAE	<i>Lanius collurio</i>	Kızılırtlı çekirgekuşu	Red backed Shrike	Open areas, parks and gardens	G	A.3	LC	ANNEX-II	ANNEX-I	L
	<i>Lanius minor</i>	Karaalın çekirgekuşu	Lesser Gray Shrike	Plain and hilly areas and gardens	G	A.3	LC	ANNEX-II	-	L
	<i>Lanius senator</i>	Kızılbaşlı çekirgekuşu	Woodchat Shrike	Gardens, wooded areas and forest edges	Y	A.2	LC	ANNEX-II	-	L

CORVIDAE	<i>Corvus monedula</i>	Cüce Karga	Eurasian Jackdaw	Wooded areas, cliffs and ruins	Y	A.5	LC	-	ANNEX II	L
	<i>Corvus frugilegus</i>	Ekin Kargası	Rook	Plains, woodlands, parks and gardens	Y	A.5	LC	-	ANNEX II	L
	<i>Corvus corone</i>	Leş Kargası	Carrion Crow	Open areas and fields	Y	A.5	LC	-	ANNEX II	L
	<i>Pica pica</i>	Saksağan	Eurasian Magpie	Open terrain with single trees and shrubs, fruit gardens, infrequently settlements	Y	A.5	LC	-	ANNEX-II	L
EMBERIZIDAE	<i>Emberiza hortulana</i>	Tarla kirazkuşu	Ortolan Bunting	Agricultural fields, meadows, steppe, arid slopes with shrubs	G	A.3	LC	ANNEX-III	ANNEX-I	L
	<i>Emberiza melanocephala</i>	Karabaş kirazkuşu	Black headed Bunting	Wooded areas, plains, gardens	G	A.4	LC	ANNEX-II	-	L
FRINGILLIDAE	<i>Fringilla coelebs</i>	İspinoz	Chaffinch	Wooded areas, parks and gardens	Y	A.4	LC	ANNEX-III	ANNEX-I	L
	<i>Carduelis chloris</i>	Florya	European Greenfinch	Wooded areas, parks and gardens, cemeteries	Y	A.3	LC	ANNEX-II	-	L
	<i>Carduelis carduelis</i>	Saka	European Goldfinch	Ornamental and fruit gardens, parks, construction areas, degraded lands	Y	A.3.1	LC	ANNEX-II	-	O, L
STURNIDAE	<i>Sturnus vulgaris</i>	Siğircık	European Starling	Settlements and fields	Y	A.5	LC	-	ANNEX-I	L
PASSERIDAE	<i>Passer domesticus</i>	Ev serçesi	House Sparrow	Human settlements	Y	A.5	LC	ANNEX-III	ANNEX II	O, L
PARIDAE	<i>Parus major</i>	Büyük baştankara	Great Tit	Wooded areas, parks and gardens	Y	A.3.1	LC	ANNEX-II	-	L

Source: The IUCN Red List Of Threatened Species 2016.3,

<http://www.iucnredlist.org/> Source: Birds of Turkey, <http://www.trakus.org/>.

MAK: Turkish Ministry of Forestry and Water Affairs "2016-2017 Hunting Period Central Hunting Commission Resolutions"

STATUS

Y : Annual Bird
G/KG : Immigrant Species
R : Random species
K : Winter Visitors
T : Transit Migrants
N : Rare Species

Symbols used regarding the protection status of bird species in The Birds of Türkiye prepared by Prof. Dr. İlhami Kızıroğlu:

A.1.2 Species whose number of individuals is between 1-10 couples in all of Turkey

A.2 : Species whose number of individuals is under 11-25 couples and which are under great risk in the areas they spread

A.3 : Species whose number of individuals is between 26-250 couples, but those which are reduced in some regions

A.3.1 : Species whose number of individuals is between 251-500 couples, but those which are reduced in some regions

A.4 : Species whose number of individuals is between 501-5000 couples and which are not under threat of extinction currently

A.5 : Common, least endangered species

A.6 : Species not adequately researched, and which no reliable information is found

A.7 : Species which no reliable information is found

B : Species which temporarily come to Turkey and will be under risk with the destruction of the biotopes B1: Species that settle in Anatolia in winters but do not breed in Anatolia

Anatolia

B2-B3: Species that pass Anatolia transit or settle in Anatolia in winter and have lower risk.

Table 47. Mammal Species Which Are Highly Probable To Be Found In The Project Area And Its Impact Area

FAMILY	SCIENTIFIC NAME	ENGLISH NAME	HABITAT	RDB	IUCN	BERN	MAK	SOURCE
ERINACEIDAE	<i>Erinaceus concolor</i>	Hedgehog	Shrubs and bushes	nt	LC	-	-	L
SORICIDAE	<i>Crocidura leucodon</i>	Bicolored shrew	Open plots and shrubs	nt	LC	Annex-III	-	L
TALPIDAE	<i>Talpa levantis</i>	Levant mole	Sandy, loose and moist soils	nt	LC	-	-	L
SPALACIDAE	<i>Spalax leucodon</i>	Mole rat	Fertile areas, vineyards and gardens	nt	DD	-	-	L
MUSTELIDAE	<i>Mustela nivalis</i>	Least weasel	Different habitats, forest, vineyard, garden, ruin, residential areas	nt	LC	-	ANNEX I:	L
CRICETIDAE	<i>Cricetulus migratorius</i>	Grey dwarf hamster	Meadow, field and steppes	nt	LC	-	-	L
LEPORIDAE	<i>Lepus europaeus</i>	European hare	All kinds of	nt	LC	-	Annex II	L
CANIDAE	<i>Vulpes vulpes</i>	Red Fox	Especially forests, wilderness, fields	nt	LC	-	ANNEX-II	L

Source: Demirsoy, A., 1997, Omurgalılar "Sürüngenler, Kuşlar ve Memeliler" [Vertebrates "Reptiles, Birds and Mammals"] Meteksan A.Ş., Ankara. Source: Demirsoy, A., 1996, Türkiye Omurgalıları "Memeliler" [Vertebrates in Turkey "Mammals"]

Source: The IUCN Red List Of Threatened Species 2016.3, <http://www.iucnredlist.org/>

MAK: Turkish Ministry of Forestry and Water Affairs "2016-2017 Hunting Period Central Hunting Commission Resolutions"

-O: Observation, L: Literature

According to Berne Convention;

Annex – 2: Species under strict protection

For the species strictly protected under **Article 6**, the following shall be prohibited.

All forms of deliberate capture and keeping and deliberate killing;

-The deliberate damage to or destruction of breeding or resting sites;

- The deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, insofar as disturbance would be significant in relation to the objectives of this Convention;

- The deliberate destruction or taking of eggs from the wild or keeping these eggs even if empty;

The possession of and internal trade in these animals, alive or dead, including stuffed animals and any readily recognisable part or derivative thereof, where this would contribute to the effectiveness of the provisions of this article shall be prohibited and relevant provisions shall be observed in the exploitation area.

Annex – 3: Protected Species

In Article 7, the following issues are provided with respect to the protected species:

Appropriate and necessary legislative and administrative measures shall be taken to ensure the protection of the wild fauna species specified in Annex III.

Any exploitation of wild fauna specified in Appendix III shall be regulated in order to keep the populations out of danger, taking into account the requirements of Article 2.

Measures to be taken shall include:

a) Closed seasons and/or other procedures regulating the exploitation;

b) Prohibition of temporary or regional prohibition of the enterprise, where appropriate, in order to achieve adequate population levels of wild fauna,

c) The regulation as appropriate of sale, keeping for sale, transport for sale or offering for sale of live and dead wild animals provisions shall be observed during exploitation.

Since those among the fauna elements with the ability to move can be seen in the project area at any time, necessary warnings will be made to the personnel involved in the project in order to prevent any damage to the fauna species.

Turkey's Key Biodiversity Areas:

The project will be carried out within the boundaries of Aydın Province. 5 of the "Turkey's Key Biodiversity Areas" are located in the province of Aydın¹⁸. These areas are the following;

¹⁸ Source: "Türkiye'nin Önemli Doğa Alanları" (Key Biodiversity Areas), Doğa Derneği, Ankara, 2006
(<http://www.dogaderneği.org>)

-Dilek Peninsula (Söke, Kuşadası): National Park, Natural protected area . The air distance to the project area is approximately 35 km.



Figure 78. Dilek Peninsula

-Büyük Menderes Delta (Söke, Didim): National Park, Natural protected area . The air distance to the project area is approximately 45 km.



Figure 79. Büyük Menderes Delta

Bafa Lake (Söke, Didim, Milas): Nature Park. The air distance to the project area is approximately 37 km.



Figure 80. Bafa Lake

-West Menteşe Mountains (Söke, Koçarlı, Çine, Karpuzlu, Yenihisar, Yatağan, Milas): Archaeological Site, Natural Protected Area. The air distance to the project area is approximately 9 km.



Figure 81. West Menteşe Mountains

-Akdağ-Denizli (Denizli centre, Kuyucak, Buharkent, Sarayköy, Honaz, Karacasu, Babadağ, Tavas): There is no protection status. The air distance to the project area is approximately 65 km.



Figure 82. Akdağ-Denizli

Important Bird Areas of Turkey:

The project will be carried out within the boundaries of Aydın Province. 3 of the "Important Bird Areas of Turkey" are located in the province of Aydın ¹⁹. These areas are the following;

-Dilek Peninsula (Söke, Kuşadası): National Park, Natural protected area . The air distance to the project area is approximately 35 km.

-Büyük Menderes Delta (Söke, Didim): National Park, Natural protected area . The air distance to the project area is approximately 45 km.

Bafa Lake (Söke, Didim, Milas): Nature Park. The air distance to the project area is approximately 37 km.

¹⁹ **Source:** Kılıç, D. T and Eken, G., "Türkiye'nin Önemli Kuş Alanları-2004 Güncellemesi-" [Important Bird Areas of Turkey - 2004 update].

II.2.13. Whether There Are Mines and Fossil Fuel Resources in the Project Area and Its Vicinity (If Any, Reserve Amounts, Current And Planned Operation Statuses, Annual Productions And Their Significance For Nationwide Or Local Use And Their Economical Values)

Mine and Energy Resources in Aydın²⁰

Aydın Province, which is one of the most important cities of the Aegean region in terms of agriculture and tourism, is one of the cities where mining is also made intensively.

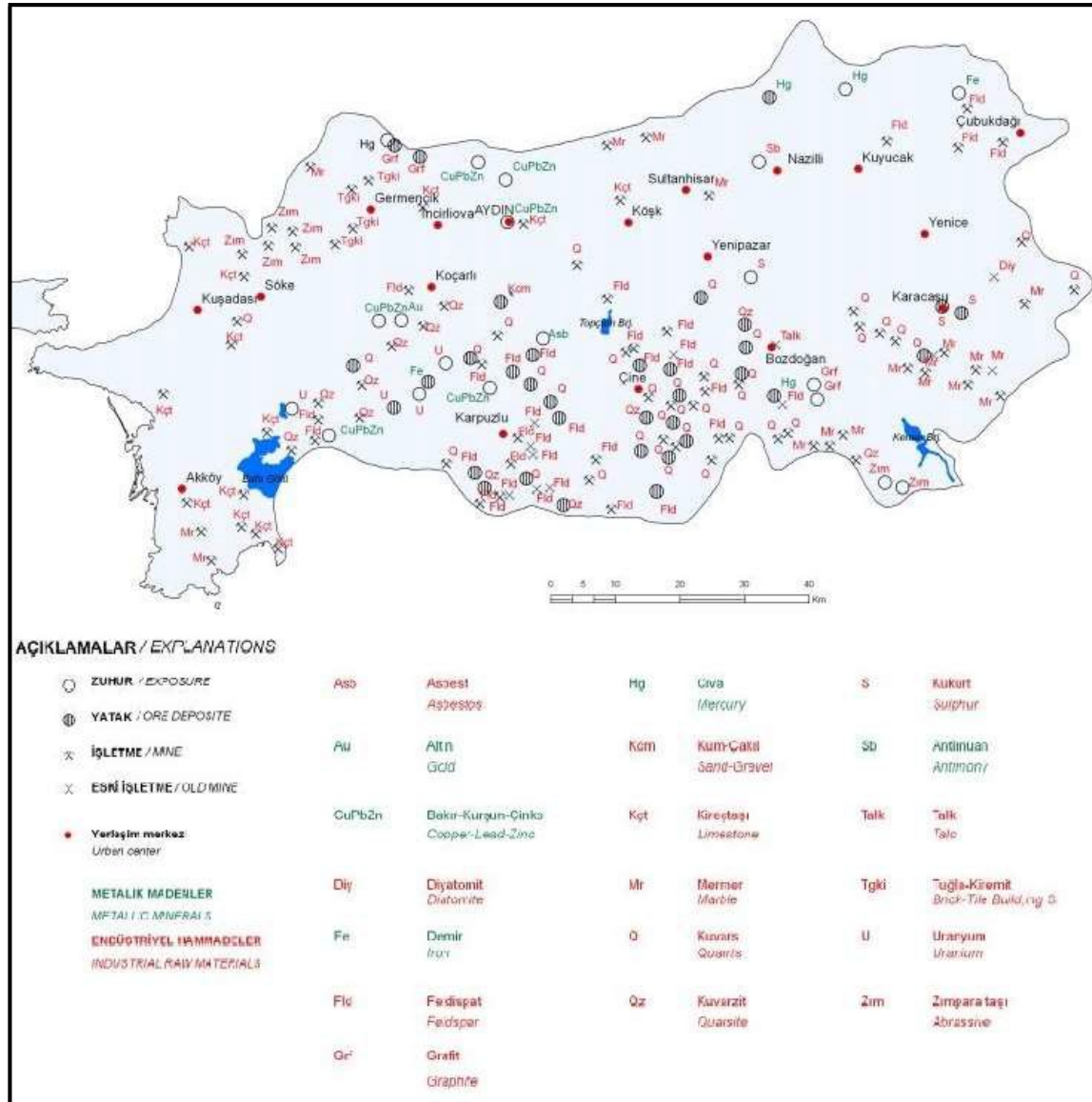


Figure 83. Mineral Map of Aydın Province

Gold, copper, lead, zinc, mercury and iron are present in terms of metallic minerals. In Koçarlı- Satılar gold mine; 1 gr/ton-grade 5.630 ton visible+possible reserve is present. Copper, lead, zinc mineralizations are found in Aydın city centre, Söke, Çine and Koçarlı districts but they are not economic because of having low-grade small-size appearances. In Bozdoğan- Altıntaş site; there is a bed with %2 cinnabar-graded 52.500 ton reserve but it is not in operation.

²⁰ Source: Mineral Research and Exploration Institute, <http://www.mta.gov.tr/>

There are small mercury appearances in Nazilli and Germencik districts. In Söke-Koçarlı-Salhane site, averagely %44.51 Fe-grade is observed. Also, in the ore bed, Fe values up to %54.46 are also determined. Average silica content of the bed is %28. Accordingly, 119,000 ton high-grade and 360,000 ton low-grade and high silica ores are observed in the ore bed. In Söke-Çavdar iron site, there is an averagely %42.62 Fe and %22.05 Si-grade. 13.500.000 ton visible and possible reserves are present. This ore bed cannot be operated due to the high silica, low-grade and partially high sulphur values.

Besides the metallic ore beds; there are rich ore beds in terms of industrial raw materials. Among them, besides the industrial raw materials such as barite, diatomite, graphite and quartz, the mines produced from the feldspar beds, which are essential for the ceramic industry, are exported to the world market.

There is a low-grade barite appearance in Çine-Yeniköy-Ozanbelenin. In Karacasu Dedeler village, partial operation is performed at the diatomite ore bed with good-quality 90% SiO₂ and 2% Al₂O₃ content. In Bozdoğan-Beyler quarter, there is a graphite appearance with low-grade 6.000-ton visible reserve.

Quartz, that is one of the ceramic raw materials, is within the boundaries of Bozdoğan-Söke-Çine districts and there are 9.663.100-ton quartz with 96.21% SiO₂ and %1.2 Fe₂O₃ mean-grade is present.

In Karasu-Dandolos site, the ore bed having % 4-5 S-grade, 51.800 ton visible and possible sulphur reserve cannot be operated due to its low-grade.

In terms of marble, Karacasu district has significant potentials. In the district; totally 30 million m³ potential marble reserve is determined in Geyre, Tepecik, Hangediği and Nargedik sites. These sites are operated by the private sector. In terms of mica, Germencik- Dağyeri site has a good quality and its reserve is not determined and thus there is no production unit in this area. In Bozdoğan-Gerzile, there is talc with medium-quality 200.000 tons of visible reserves.

In Koçarlı-Çavdar-Küçükçavdar site; %0.0425 U₃O₈ (autinite)-grade 208,942 tons visible, and in Çavdar-Arapsu site, %0.02-0.03 (autinite and torbernite)-grade 10,784 tons and more than %0.03-grade 19.508 tons of possible uranium reserves are observed.

In Çavdar-Demirtepe site, %0.0234-grade 263,343 tons of U₃O₈ with %0.0234-0.0956 (autinite, bassetite, uranopilite) quality and %0.0956-grade 1,456,687 tons of U₃O₈, that is totally 1,728,207 tons of visible and possible uranium reserves is present. In Kısır-Osmankuyu site, %0.02-0.03 U₃O₈ uraninite, gummite, uranotile, torbernite, autinite, meta-autinite, meta-torbernite, phosphoranilite minerals are determined and totally 45,895 tons of possible uranium reserves is present as %0.02-0.03-graded 11,530 tons of U₃O₈ and more than % 0.03-graded 34,365 tons of U₃O₈.

In Karacasu and Söke districts; 55-60% Al₂O₃ (Karacasu), 44-55% Al₂O₃ (Söke)-graded ore beds as corundum, magnetite and sandpaper are present and in Karacasu; 172,000 tons of visible+possible and in Söke, 55,000 tons of possible reserves are determined. Operated sandpaper beds are present.

Our country is in the first rank in albite production in the world. Almost all the production is performed in Çine - Milas. There are facilities for feldspar enrichment in this region. From Çine-Milas region, about 1.5 million tons/year of albite is exported. In Aydın city centre, Söke district and Çine-Karpuzlu-Akçaova ore beds; 8-11.44% K₂O and 0.73% Fe₂O₃ containing 1,878,516 tons of possible and medium-low quality 151,819 tons of possible orthoclase (potassium feldspar) reserves that can be used as an additive in ceramic and 8.35-11% Na₂O₃ and 0.7% Fe₂O₃ containing good-quality 67,363,515 tons of possible and 21,987,172 tons of medium-low quality albite (sodium feldspar) reserves are present.

These ore beds are operated regarding to domestic and foreign markets in order to be used in ceramic and glass industry.

Aydın has important potential in terms of geothermal energy resources. These geothermal fields, which have multiple uses such as hot spring, heating the hot spring facility, greenhouse heating, electricity generation, urban heating, are very effective in the development of provincial tourism and industry. Some important geothermal areas in the province are Yılmazköy, Germencik-Ömerbeyli, Bozköy-Çamur, Umurlu-Serçeköy, Pamukören, Germencik-Gümüş, Sultanhisar, Salavatlı, Kuşadası-Ilıca, Buharkent-Ortakçı and Nazilli-Gedik sites. In the drilling carried out in Pamukören geothermal area, the fluid having 188 °C temperature and 58 lt/s flow was made visible and geothermal energy with 37 MWt thermal power was gained. In Bozköy-Çamur site, the fluid with 59-142°C temperature and 280 lt/s flow has 107 MWt thermal power, and in the Ömerbeyli site the fluid with 203-232°C temperature and 725 lt/s flow has a thermal power of 594.83 MWt.

The project area is registered as J-553 Geothermal Resources and Mineral Water Operation License Area in the General Directorate of Mining Affairs.

Within the scope of the project, the provisions of the Mining Law numbered 3213, Mining Activities Application Regulation and the Law on Geothermal Resources and Natural Mineral Waters numbered 5686 shall be observed.

II.2.14. Livestock and Aquaculture (Species, Feeding Areas, Annual Production Quantities, Place and Value of These Products in the Country Economy, Fisheries, Drive-in Fisheries within the Impact Area)

Livestock is developed in Aydın province due to factors such as vegetation and climate. Mainly sheep, hair goats and cattle are bred. Beekeeping is developing and poultry is also important in some regions.

Cattle breeding data for the province of Aydın and Germencik are given in the table below.

Table 48. Cattle Breeding Data for Aydın Province in 2015

Animal Name	Adult	Young-baby	Total	Number of milked animals	Milk (Ton)
Cattle (Culture	180,344	72,416	252,76	92,902	368,358
Water buffalo	488	40	528	162	195
Cattle (Cross-	33,594	13,169	46,763	15,175	41,125
Cattle (Domestic)	26,466	10,706	37,172	11,818	16,509

Source: TurkStat, www.tuik.gov.tr, January, 2017.

Table 49. Cattle Breeding Data for Germencik District in 2015

Animal Name	Adult	Young-baby	Total	Number of milked animals	Milk (Ton)
Cattle (Culture	9,762	4,388	14,15	5,052	20,031.180
Cattle (Cross-	1,347	603	1,95	705	1,910.008
Cattle (Domestic)	137	63	200	70	98,349

Source: TurkStat, www.tuik.gov.tr, January, 2017.

Ovine breeding data for the province of Aydın and Germencik are given in the table below.

Table 50. Ovine Breeding Data for Aydın Province in 2015

Animal Name	Adult	Young-baby	Total	Number of milked animals	Milk (Ton)
Sheep (Native)	158,622	43,648	202,27	93,339	7,84
Goat (hair)	79,638	26,686	106,324	48,757	5,217
Goat (Angora)	2	0	2	1	0
Sheep (Merino)	2,639	660	3,299	1,653	81

Source: TurkStat, www.tuik.gov.tr, January, 2017.

Table 51. Ovine Breeding Data for Germencik District in 2015

Animal Name	Adult	Young-baby	Total	Number of milked animals	Milk (Ton)
Sheep (Native)	3,25	1,03	4,28	1,702	142,934
Goat (hair)	2,125	705	2,83	1,228	131,417

Source: TurkStat, www.tuik.gov.tr, January, 2017.

Poultry data for the province of Aydın and Germencik are given in the table below.

Table 52. Poultry Raising Data for Aydın Province in 2015

Animal Name	Current number
Broiler	2,776,180
Laying Hen	631,682
Turkey	6,478
Goose	2,717
Duck	3,238

Source: TurkStat, www.tuik.gov.tr, January, 2017.

Table 53. Poultry Raising Data for Germencik District in 2015

District Name	Animal Name	Current number
Germencik	Broiler	600

Source: TurkStat, www.tuik.gov.tr, January, 2017.

Aquaculture

The fact that Aydın has marine resources and at the same time aquaculture in the inner waters of the region is among the main reasons it. The aquaculture sector, which is one of the growing sectors in our country, is carried out intensively especially in Muğla and its vicinity. In addition, hunting is also an important production method in the region. According to the reports of the World Food and Agricultural Organization, the aquaculture sector, which is one of the fastest growing food sectors in the world, is developing in the Aegean Region in the same way. Many facilities have been established in the region in recent years and these facilities operate at full capacity to meet the increasing demand. Processed products especially attract attention in the European market and efforts are being made to establish new facilities in the region due to increasing demand.

Aquaculture in the coastal regions, inland waters aquaculture and hunting activities are in the foreground in Aydın. Culture fishing, which does not have a long history, was established as individual enterprises at first. In time, with the change in the market structure and the increase in costs, the small actors in the sector were withdrawn and this area was mostly controlled by large companies. The following figure shows the amount of aquaculture products produced in Aydın province.

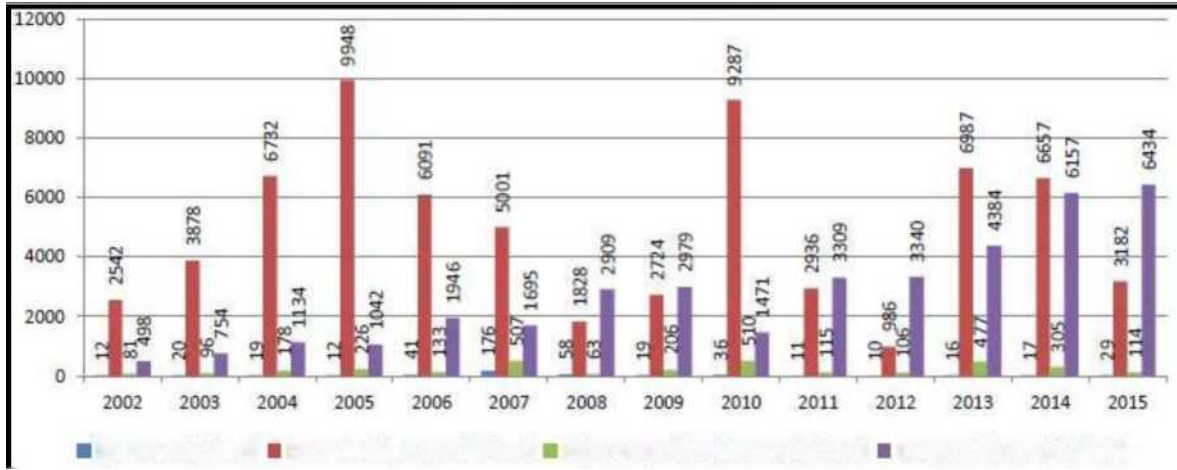


Figure 83. Quantities of Marine Products in Aydın Province by Years

Source: Aydın Province Environmental Status Report for 2015

II.2.15. Areas of High Landscape Value and Recreation Areas

There are no areas of high landscape value in the project area and its vicinity.

The area where the project will be applied will differ from the present situation both visually and structurally during the construction period of the project and during the operation phase. For this reason, after the construction period and after the operation is closed regarding the project, necessary works shall be carried out in order to restore the area and planting activities in accordance with the vegetation cover of the region shall be made.

In addition, a topography similar to its natural appearance will be achieved in the operation phase of the project with the arrangements and improvements made to the topography deformed during the construction phase. Greening and planting works will be carried out in unused areas after the plant area is completed.

There are no protected areas (National Park, Nature Park, Natural Monument, Nature Conservation Area, Wildlife Conservation Area, Biogenetic Reserve Area, Biosphere Reserves, Natural Protected Area and Memorial, Historical, Cultural Protected Area, Special Environmental Protection Region, Special Environmental Protection Area, Tourism Area and Centre) within the project area that can be considered as cultural landscape elements.

II.2.16. Lands Owned By The State's Authorized Bodies (Military Forbidden Zones, Areas Allocated To Public Bodies And Institutions For Certain Purposes, etc.),

In the project area, there are no lands that are owned by the authorized bodies of the state (military forbidden zones, areas allocated to public bodies and institutions for certain purposes, etc.).

II.2.17. Current Pollution Load Of The Project Area And The Impact Area (Determination Of The Current Pollution Load In Terms Of Air, Water, Soil And Noise, Statement Of The Dates And Type Of Surveys And Their Methods And The Meteorological Conditions During The Survey Period)

Air quality measurements are carried out by the investor company to determine the current situation. Tubes placed for measurement of H₂S were sent to GRADKO Environmental Laboratory in England.

Table 54. Regular Measurements for Determining the Current Situation

Item	Parameter	Period	Location
1	H ₂ S	Continuous	At certain points in the license area

The measurements and the samples taken from the J-553 license area were carried out by accredited authorized laboratories. The results of H₂S measurements²¹ carried out at 3-month intervals at certain points of the license area in 2015 and after are given in Annex-18.

"Current Pollution Load of the Region" and "Impacts of the Planned Project to the Current Pollution Load" is provided in Section III.2.22.

II.2.18. Other Issues

There are no other issues required to be mentioned in this report.

II.3. Characteristics of Socio-Economic Environment

II.3.1. Economic Characteristics (The Main Sectors that Constitute the Economical Structure of the Region, Distribution of Regional Labour Force Among These Sectors, Place and Importance of Production of Goods and Services in the Sectors Regarding the Region and Country, Other Information); Income (Distribution of Income in the Region Among the Branches Of Activity, Maximum, Minimum and Average Income Per Capita By Branches of Activity), Unemployment (Unemployed Population in the Region and Its Proportion To the Labour Force).

Economic Structure²²

Aydın is generally known as an agricultural and tourism city. The weight of agriculture, which forms the basis of economic life, is also felt in industry and trade sector. 55% of the population makes a living from agriculture sector. The importance of Aydın for the agriculture of our country is revealed by taking place in the top ten list of Turkey for agricultural products produced in our country. Aydın province is number one in fig and chestnut production and number two in olive, cotton, artichoke and strawberry number three in peanut production.

The second important sector after agriculture is tourism. Aydın province, which hosted many civilizations and has an outdoor museum appearance, has many historical, cultural, touristic and natural values. While the tourists come to Kuşadası and Didim districts, which have potential in every area of tourism and are one of the important tourism centres of our country, for the aim of accommodation, they visit to other districts with natural, archaeological and folkloric values.

Approximately 5.3 million domestic and foreign tourists visited Aydın in 2013, while this figure increased to 5.5 million in 2014. While the occupancy rate in tourism facilities was 53% in 2012, it increased to 76% in 2013 and 74% in 2014.

Aydın has entered the process of industrialization in recent years and continues to make rapid progress in this regard. Its industry is mainly composed of production of food through processing agricultural products, manufacturing of textile products, manufacturing of machinery and equipment, mining and quarrying, automotive sub-industry, production of white goods and manufacturing of chemicals.

²¹ Source: Çınar Çevre Laboratuvarı A.Ş.

²² www.aydin.gov.tr, Aydın İl Rehberi (Aydın Province Guide), January, 2017.

While some of the products produced in Aydın are consumed in the domestic market, others are exported abroad. In addition to agricultural products such as fresh vegetables and fruits, pickled olives, canned foods, tomato paste, processed figs; agricultural machinery, olive oil machinery, automotive sub-industry products, white goods products, feldspar, quartz, marble and bottled drinking water among the underground treasures are exported to different countries of the world. According to the data of the Under secretariat of Foreign Trade, the export figures of Aydın, which was 96 million dollars in 2000, reached 697 million 489 thousand dollars in 2013. The share of Aydın province in the country's economy has risen from three per thousand to five per thousand. USD 744.314.000 according to the data of 2014, and USD 366.237.000 in January-July 2015 period was exported.

The ratio of budget revenues to cover expenditures was realized as 82% in the first six months of 2015 in Aydın.

Labour Force Data of Aydın Province ²³

When the distribution of the companies in the province of Aydın by sectors is examined, it is seen that most companies are involved in construction sector. Approximately one of every 4 companies are in the construction sector. This sector is followed by Wholesale and Retail Trade (22.6 percent) and Manufacturing (19.0 percent) respectively. A total of 41 thousand 958 people is employed in the companies covered by the survey in Aydın. 69.8 percent of the employees are male, and 30.2 percent are female. When the distribution of the employees in the province of Aydın is examined according to their occupational groups; it is seen that the most employees are included in the profession group of Craftsman. 23.5 percent of the employees are in this profession group. In the survey, it was determined that 8 percent of males and 6.5 percent of females work in jobs that do not require qualifications.

In Aydın province, 6 percent of the companies have part-time employees. There are companies in 16 sectors within the scope of the survey in Aydın, 9 sectors have part-time employees. The number of companies that have the most part-time employees in the province is in the Accommodation and Food Services sector. 18.8 percent of the companies in the province of Aydın do shift work. While the most sectors with shift work in Aydın province are; Electricity, Gas, steam and air Conditioning Production and Distribution sector and Accommodation and Food Services, it is Accommodation and Food Services sector in Turkey general with 47.2 percent. Export is made in 9 out of 16 sectors operating in the province. 31.8 percent of the employees are employed in export trading companies. In the province of Aydın, while the vast majority of the employees in the export trading companies are men, women employees in export trading companies in sectors of Wholesale and Retail Trade, Professional Scientific and Technical Activities is more than man.

In the scope of the survey conducted in 2015 in the province of Aydın, 650 job vacancy was determined in 201 different occupations, this figure was 771 in 246 different occupations in the previous year. From this point of view, a decrease was observed in the number of job vacancies and occupational diversity in 2015 compared to the previous year.

17.3 percent of the companies in the province of Aydın stated that they have job vacancies. The job vacancy rate of the province was determined as 3.8 percent in 292 companies in Aydın. The most job vacancy in Aydın province is in the Accommodation and Food Services sector with a ratio of 29.2 percent. Production sector is the second with 21.4 percent and Transportation and Storage sector is the third with 17.8 percent.

²³ İSKUR, Aydın İş Gücü Piyasası Araştırma Raporu [Aydın Labor Market Research Report], 2015

While only women were demanded for 14.6 percent of total job vacancies, men were demanded for 41.5 percent in Aydın. No gender discrimination was made in 43.9 percent of job vacancies. In Aydın, mining and quarrying sector is the sector with most job vacancies with 35.7%. The ranking continues with Accommodation and Food Services sector with 27.7 percent followed by manufacturing sector with 22.9 percent. There are no job vacancies in Electricity, Gas, Steam Production, Information and Communication, Finance and Insurance Activities, Culture, Art Entertainment, Leisure and Sport Services sectors in Aydın province.

When the distribution of the job vacancies in the province of Aydın is examined according to their occupational groups; it is seen that the most job vacancies are included in the profession group of Craftsman. This occupation group is followed by Service and Sales Persons, Plant and Machine Operators groups respectively. Job vacancies in the Agriculture, Forestry and Fisheries profession group, demanded men in all the jobs, while job vacancies in Bureau Services, Non-Qualified Professions and Learned Profession Groups occupational groups demanded women compared proportionally to men. The first three occupations with the highest number of job vacancies were respectively Manufacturing Worker, Waiter (Service Person) and Service Bellboy. While top three occupations in job vacancies for women are Room Clerk -Tourism, mechanic (sewer) and Waitress (Service Staff), top three for men are Gas Metal Arc Welding Staff, Electrician-Construction, Sales Representative.

When the education levels demanded by the sectors are examined, the most demanded education level in manufacturing, construction, transportation and storage sectors is below high school level, those in accommodation and food service, wholesale and retail trade, administrative and support services, mining and quarrying sectors, human health and social services, education, vocational, scientific and technical activities is bachelor level.

The most expected increase in employment is in Nuts Packaging Worker, while the most expected reduction in employment is in Construction Master (General). It is noteworthy that the cleaning staff and the Plasterer professions are among the top ten jobs expected both to increase and decrease in employment levels. From a sectoral perspective; while the sector expecting the highest increase in employment in Aydın is the Mining and Quarrying sector with 35.7 percent, the highest decrease expected is in the education sector with 12.9 percent.

As of the end of June 2015, the number of unemployed persons registered to İSKUR is 43 thousand 624. According to the distribution of the registered unemployed persons by occupations, the first rank is the Manual Worker (General), while Sales Representative, Cleaning Officer, Office Clerk (General), Secretary, Driver-Freight Carriage, Waiter (Service Staff), Pre-Accountant, Manual Worker (Cleaning) and Cashier follows the respectively in the ranking. The fact that the professions that do not require qualifications in the table are more likely to be employed in the companies where seasonal agricultural workers are employed and these firms constitute the majority of the firms in the province, have caused the registered unemployed to concentrate on occupations that do not require qualifications.

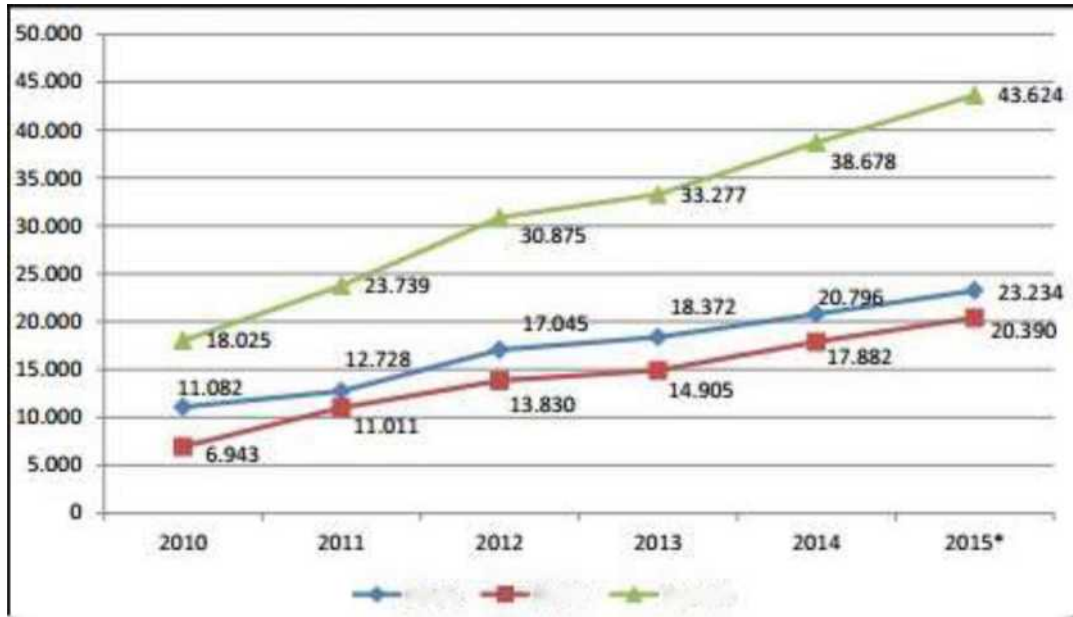


Figure 85. Distribution of Registered Unemployed by Gender in Aydın

When the job placement in the first six months of 2015 are examined on the basis of occupation; in the first two positions are the Manual Worker (General) and the Caretaker professions. These professions are followed respectively by Production Worker, Tourism and Hotel Management Staff, Meter Reading Staff (Water), Security Officer, Waiter (Service Staff), Office Clerk (General), Room Clerk-Tourism and Nurse professions.

When we look at the occupations in the registered unemployed, job vacancy and job placement indicators, it is seen that the occupations demanded by the labour market and the registered unemployed people overlap on the basis of occupations. This situation is also revealed in the distribution of job placements by occupations.

A total of 41 thousand 958 people is employed in the companies covered by the survey in Aydın. 69.8 percent of the employees are male, and 30.2 percent are female. 72.5 percent of the employees in the companies employing 10 and more people is men and 27.5 percent is women in Turkey general. The share of women in total employees is low in Aydın. According to the results of 2014 Regional Household Labour Force Survey, the employment rate of women in TR32 region, which also includes Aydın, is 11.1 point above the average of Turkey in general. However, women in the region are working as unpaid family workers in the agricultural sector. Since the agricultural sector was out of scope in this survey, the ratio of women among total employees was low (30.2 percent).

The rate of women employed in Production and Wholesale And Retail Trade sectors (15.2 percent), which occupies the position for having the most employees in Aydın province, is below the rate of women employed in these sectors in Turkey general (18.5 percent). The number of women working in the health and education sectors is greater than the number of men working in both Turkey and Aydın. The rate of women working in companies covered by the survey in Aydın (30.2 percent) is similar to the rate of it in Turkey general (27.5 percent) The highest number of employees in Aydın is found in the manufacturing, construction, wholesale and retail trade sectors. 63.5 percent of the employees are in these sectors. Manufacturing sector is the sector which both men and women are employed most, construction sector is the sector which men are employed most, Wholesale and Retail Trade is the sector which women are employed most.

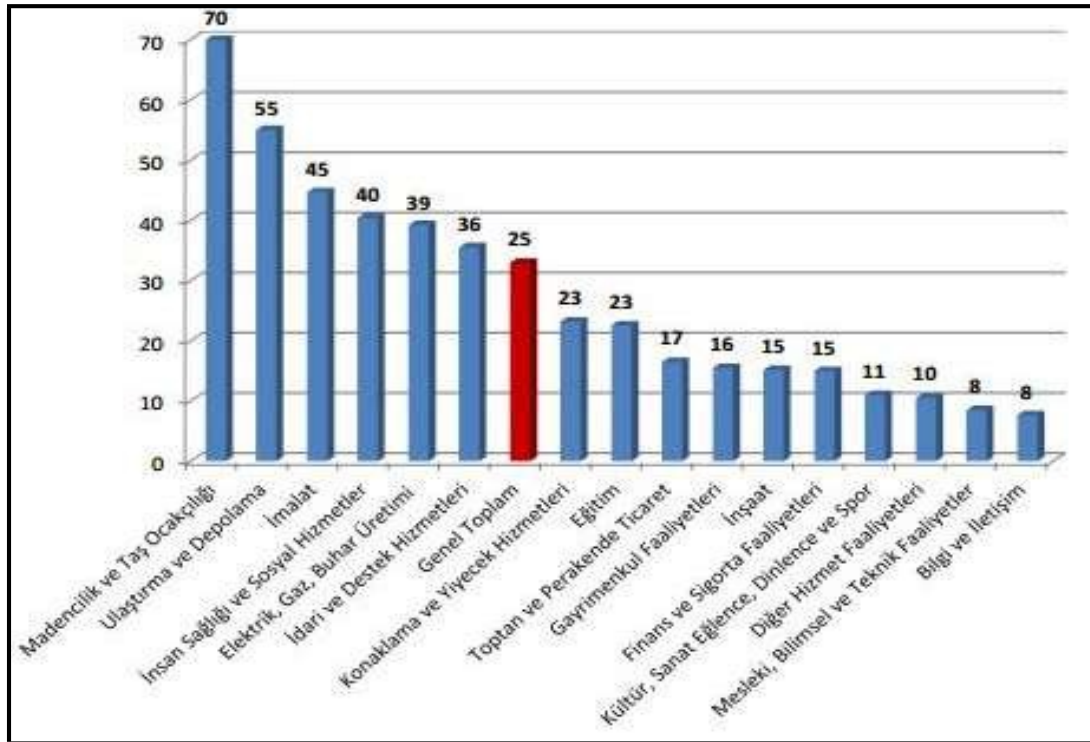


Figure 86. Average Number of Employees by Sector in Aydın

It is observed that problems such as the lack of intermediate level labour force which especially manufacturing sector is in need, the fact that women are not in labour force with respect to their population ratio in Aydın province, lack of raising cultural consciousness for personal characteristics demanded by the employers, lack of corporate approach prioritizing planning for seasonal labour force in Aydın province become apparent. A vocational and technical education, which provides training in broad-based sectoral education instead of narrowly defined occupation fields and which can meet the needs of work life by means of modular structure and flexibility feature shall be aimed for the purpose of contributing to the acceleration of economic development in the province of Aydın. Trainings must be really qualified, teach the skills which companies require, and they shall offer guarantee for employment. In order to determine the form and content of the trainings to be provided for this purpose, it is very important to get the opinions of the employer representatives from the related fields as well as the vocational training specialists.

In addition, women are expected to be locomotives in the labour force due to the population density in Aydın. In Aydın province, there is a need for the preparation of projects that will enable women to be more involved in the labour force, awareness-raising activities on this issue throughout the province and civil society organizations to operate in this regard.

It is seen that a corporate and professional approach is needed in tourism sector which is the most important economic income source of Aydın province. The fact that tourism sector dominates the job vacancies and occupations which are hard to find employees require employers to take serious steps towards institutionalization. In other words, an alternative human resources approach is needed for the employers to recognize the idea of career backup and building a team, and which would reduce the seasonal impact to minimum.

II.3.2. Population (Urban and Rural Population in the Region, Population Movements, Migration, Population Growth Rates, Average Household Population, Other Information)

The scope of activity of the project is within the administrative boundaries of Aydın. Population information of Aydın province is elaborated in the table below according to the Address Based Population Registration System (ADNKS) database of 2015.

Table 55. Aydın Province Population Information

Year	Male Population	Women's Population	Total population
2015	525,267	528,239	1,053,506
2014	519,900	522,079	1,041,979
2013	510,512	510,445	1,020,957
2012	502,337	504,204	1,006,541
2011	499,194	499,969	999,163
2010	495,363	494,499	989,862
2009	489,857	489,298	979,155
2008	482,434	483,066	965,500
2007	473,481	473,490	946,971

Source: TurkStat, www.tuik.gov.tr, January, 2017.

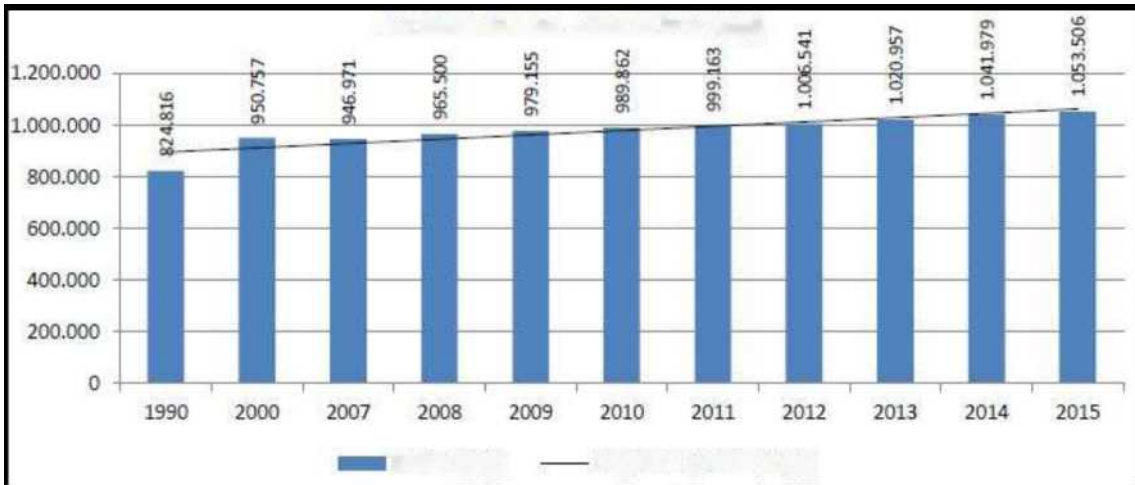


Figure 87. Aydın Province Population Growth Chart by Years

The population information of districts of Aydın are given in Table.56.

Table 56. Population Information of District of Aydın

District	Population in 2015	Men	Women
Efeler	277,466	138,132	139,334
Nazilli	151,789	74,695	77,094
Söke	116,583	58,721	57,862
Kuşadası	103,849	52,178	51,671
Didim	73,827	37,740	36,087
Çine	50,241	24,987	25,254
İncirliova	47,475	23,724	23,751
Germencik	43,367	21,575	21,792
Bozdoğan	34,237	17,151	17,086
Kuyucak	27,182	13,401	13,781
Köşk	27,039	13,752	13,287
Koçarlı	23,422	11,620	11,802
Sultanhisar	20,983	10,158	10,825
Karacasu	19,162	9,435	9,727
Yenipazar	12,937	6,155	6,782
Buharkent	12,505	6,153	6,352
Karpuzlu	11,442	5,69	5,752

Source: TurkStat, www.tuik.gov.tr, January, 2017.

The population of Germencik is 43.367 according to the Address Based Population Registration System (ADNKS) database of 2015.

Table 57. Germencik District Population Information

Years	Male Population	Women's	Total population
2015	21,575	21,792	43,367
2014	21,498	21,758	43,256
2013	21,498	21,711	43,209
2012	21,299	21,672	42,971
2011	21,249	21,775	43,024
2010	21,410	21,936	43,346

Source: TurkStat, www.tuik.gov.tr, January, 2017.

Population Movements, Migrations ²⁴

Aydın has been one of the main migration centres of the Western Anatolia Region since 1945, with İzmir and Manisa and is subject to significant migration flow.

In the mid-1950s, especially in the first period, it has entered into a significant migration outflow process and the outflow was generally to the big cities such as Istanbul, Ankara and İzmir with long distance and permanent family scaled nature.

²⁴Aydın Province Environmental Status Report for 2011

The short-distance temporary migration, which have remained important after the 1960s, as well as the long-distance permanent family migration, has eliminated this negative effect and the share 15-64 age group has increased again and the increase in the labour force has been equivalent to general population. The activity rate remained unchanged during the 1965-1975 period. At the same time, the relative significance of the migration inflow was increased, and the net population gain increased significantly. In the 1965-1970 period, 55,812 people moved to Aydın while 46,877 people migrated to other provinces which resulted in population gain of 9.335 in the province. It brought 17.1 gain to the general population. Thus, Aydın is the second most significant province after İzmir in the Western Anatolia Region in terms of net immigration rate. The tourism movement intensified in Kuşadası and Didim has a certain share in the immigration inflow to Aydın.

The economic characteristics of the population migrating to Aydın show that the movement is generally at a temporary level of migration that meets the seasonal labour demand. The agricultural sector has the highest share in the distribution of migrants by branches of activity. The fact that second position is occupied by services implies that the employment opportunities of tourism encourage migration to Aydın. In the distribution of migrants by their work places, wage earners have a certain share. The weight of women and family workers in wage-earners is the result of the traditional preference of women and children in harvesting products such as cotton and olive. In the distribution of migrants by the main profession, scientific and technical staff, self-employed persons and those working for personal services have shares considered to be significant besides agriculture. However, although these shares have a parallel distribution with the general in Turkey, tourism activities have an impact on these. University has greatly contributed to the population increase in the recent years in the Province. This has also changed the quality of the migrant population.

In Aydın, seasonal family migration from the surrounding provinces is significant. The presence of large-scale agricultural enterprises in the province and the increase in the construction sector brought by tourism in particular on the coastal side, intensifies the use of wage labour. As a matter of fact, 45% of those who migrated to the province in 1975 are seasonal agricultural workers originating from surrounding provinces such as Muğla, Denizli, Burdur, Afyon, Isparta. The agricultural sector has the highest share in the distribution of migrants by branches of activity. The fact that second place is occupied by services indicates that employment opportunities created by tourism encourages migration to Aydın. While migrant families do not have a collective residence, some of the migrant workers who come to work in the agricultural sector stay in the shelters that some landowners have built in their own land, and some of them reside in their own tents they built.

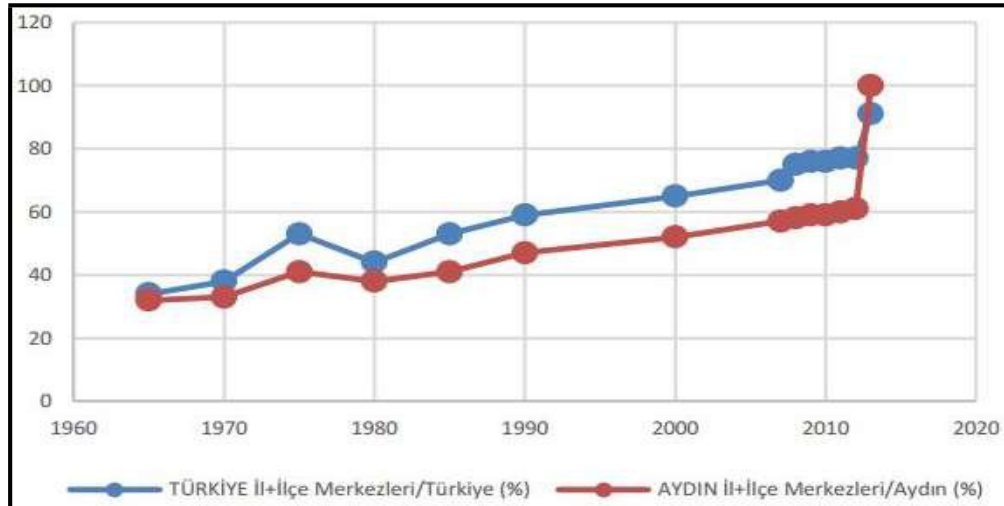


Figure 88. The Change in the Urban Population in Aydın and Turkey General

Source: Aydın Province 2014 Environmental Status Report

The chart above shows that the increase in urban population in Aydın province is below the increase in urban population in Turkey general but it is close to the general.

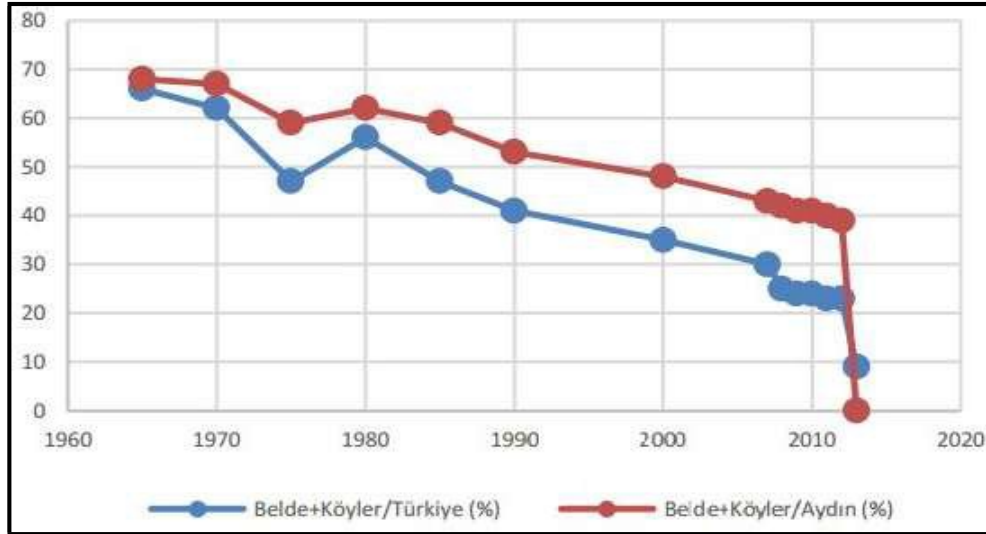


Figure 89. The Change in the Rural Population in Aydın and Turkey General

Source: Aydın Province 2014 Environmental Status Report

The chart above shows that the decrease in rural population in Aydın province is significantly above the decrease in rural population in Turkey general.

The rate of urban population, which was 51.32% in 1990, increased to 59.25% in 2000. Social, economic, demographic and environmental problems have emerged due to rapid urbanization. Cities have become problematic in terms of service provision and environmental problems rapidly developed due to unplanned urbanization and squatting.

II.3.3. Urban and Rural Land Uses (Distribution of Settlement Areas, Current and Planned Use Areas, Industrial Zones, Residential, Tourism Areas etc. within this Framework); Social Infrastructure Services in the Region (Education, Health, Cultural Services and Utilization of these Services)

Urban and Rural Land Use²⁵

Total land use area in Aydın is 800.447,8 hectares. Details of land use areas are given in the table below.

Table 58. Land Use in Aydın Province

Use area	Area (ha)	Rate (%)
Urban Settlements	11,593.9	1.4
Rural Settlements	6,579.9	0.8
Agricultural Areas	386,272.4	48.3
Forest Areas	276,480.9	34.5
Meadow-Pasture Areas	39,403.2	4.9
Shrubberies	66,750.8	8.3
Other Uses	13,366.7	1.8
Total	800,447.8	100

Source: Aydın-Muğla-Denizli 1/100.000 Ölçekli ÇDP Araştırma Raporu [Aydın-Muğla-Denizli 1 / 100.000 Scale Environment Plant Research Report]

²⁵Aydın Province Environmental Status Report for 2011

There are 17 district centres whose urban settlements are within the province in Aydın. Among these centres, the City Centre is the most densely urbanized settlement. According to TURKSTAT data, the two districts with the highest gross population density are the Central District and Kuşadası District. The densities of the other districts are ranked as Bozdoğan and Karacasu, Çine, Karpuzlu, Koçarlı, Kuyucak, Sultanhisar, Yenipazar, Buharkent, Didim, Germencik, Söke, Incirliova, Köşk and Nazilli respectively.

Agricultural land has a high value with 48.3% of the land use. Aydın, where the Great Menderes River passes through, is an advantageous province in terms of fertile agricultural lands. Forest areas also have a high value of 36%.

EDUCATION

According to the latest data from Aydın Provincial Directorate of National Education, there are 360 kindergartens, 3.023 elementary schools, 1.467 general high schools and 1.505 vocational high schools in Aydın. The number of schools, classrooms and students in Aydın province according to education levels is given in Table.59.

Table 59. School- Classroom- Teacher and Student Status for 2016-2017 Education Year Aydın Province in General

SCHOOL TYPE	Number of School	Number of Classroom	Branch	Total Number of Teachers			Total Number of Students		
				Total	Men	Women	Total	Boy	Girl
Official Kindergarten	41	194	278	297	19	278	5.298	2.569	2.729
Private Kindergarten	19	112	82	87	11	76	953	424	529
Kindergarten Total	60	306	360	384	30	354	6.251	2.993	3.258
Kindergarten within the Body of Official Primary School	250	306	400	391	12	379	7.049	3.674	3.375
Kindergarten within the Body of Official Secondary School	39	45	62	66	2	64	1.040	548	492
Application Kindergarten within the Body of High School	7	14	15	45	1	44	222	104	118
Kindergarten within the Body of Official High School	1	3	2	0			23	14	9
Kindergarten within the Body of Private Primary School	15	38	37	42		42	488	252	236
Total (Bünyeli?) Kindergarten	312	406	516	544	15	529	8.822	4.592	4.230
Pre-school Grand Total	60	712	876	928	45	883	15.073	7.585	7.488
SHÇEK (Social Services And Child Protection Agency) Preschool Institutions	24		89	81		81	1.068	551	517
Primary School With Multigrade Class	96	323	374	183	92	91	2.142	1.125	1.017
Independent Primary School	225	2.661	2.491	3.182	1.328	1.854	47.562	24.338	23.224
Private Primary School	20	267	158	274	70	204	2.728	1.456	1.272
Total Primary School	341	3.251	3.023	3.639	1.490	2.149	52.432	26.919	25.513
Independent Secondary School	182	2.338	2.133	3.633	1.643	1.990	50.234	25.696	24.538
Regional Boarding Secondary School	1	12	8	19	14	5	157	96	61
Imam Hatip Secondary School	25	252	182	254	123	131	3.677	2.024	1.653
Boys' Imam Hatip Secondary School within the Body of Imam Hatip High	1	0		0			0		
Girls' Imam Hatip Secondary School within the Body of Girls' Imam Hatip High School	2	10	9	0			166		166
Imam Hatip School Total	28	262	191	254	123	131	3.843	2.024	1.819
Private Secondary School	25	256	250	444	152	292	4.360	2.314	2.046
Total Secondary School	236	2.868	2.582	4.350	1.932	2.418	58.594	30.130	28.464
Total Primary and Secondary School	577	6.119	5.605	7.989	3.422	4.567	111.026	57.049	53.977
General High School	46	965	1.124	1.694	862	832	21.907	9.618	12.289
Private high school	33	411	343	602	285	317	4.533	2.363	2.170
Total General High School	79	1.376	1.467	2.296	1.147	1.149	26.440	11.981	14.459
Mixed Anatolian Imam Hatip High School	13	215	105	180	88	92	1.666	1.156	510
Boys' Anatolian Imam Hatip High School	1	29	58	32	26	6		335	
Girls' Anatolian Imam Hatip High School	2	35	54	31	11	20	727		727
Imam Hatip High Schools	16	279	217	243	125	118	2.728	1.491	1.237
Vocational and Technical Anatolian High School	42	810	1.483	1.826	1.008	818	18.117	10.295	7.822

Private Vocational and Technical Anatolian High School	3	63	22	74	15	59	1.039	404	635
Total of Vocational and Technical Education	45	873	1.505	1.900	1.023	877	19.156	10.699	8.457
Secondary Education Grand Total	140	2.528	3.189	4.439	2.295	2.144	48.324	24.171	24.153
Counselling And Research Centre	3			44	30	14	0		
Science and Art Centre	1	11		11	5	6	250	126	124
Hearing Impaired Primary School (Official)	1	4	4	4	1	3	8	7	1
Hearing Impaired Secondary School (Official)	1	4	4	11	9	2	24	17	7
Primary School (Mild Intellectual Disability)	2			0			0		
Secondary School (Mild Intellectual Disability)	2	5	7	13	8	5	39	28	11
Special Education Application Centre 1st Level	4	18	24	17	7	10	110	65	45
Special Education Application Centre 2. Level	4	17	28	33	20	13	102	67	35
Special Education Vocational Education Centre (3rd Level)	3	34	49	59	30	29	286	177	109
Special Education Job Application Centre (3rd level)	3	14	20	37	12	25	123	73	50
Special Education Total	24	107	136	229	122	107	692	434	258
Formal Education Grand Total	801	9.466	9.806	13.585	5.884	7.701	175.115	89.239	85.876
Public education Centre	17	93		186	74	112	261.080	136.527	124.553
Vocational Education Centre	10	60		153	125	28	5.728	5.124	604
Total of Lifelong Learning	27	153		339	199	140	261.080		
Teacher's house	7			14	14		0		
INSTITUTION-SCHOOL TOTAL	835	9.619	9.806	13.938	6.097	7.841			
Special Education and Rehabilitation Centre (Private)	26	412		316	85	231	4.400	2.632	1.768
Private Motor Vehicle Driving Course	52	163		382	246	136	24.176	18.816	5.360
Private Education Course	25	203		108	56	52	1.403	654	749
Private Student Education Centre	31	172		107	26	81	1.164	602	562
Private Various Courses	27	118		95	65	30	2.286	866	1.420
Private Dormitory	86			0					
Private Non-Formal Education Total	247	1.068	0	1.008	478	530	33.429	23.570	9.859

Source: Aydın Provincial Directorate of National Education, <http://aydin.meb.gov.tr>, January, 2017.

Tourism²⁶

Aydın city, beyond having historical, cultural and natural values, is in the middle of Western Anatolia where tourism activities are the densest. Also having the most important sea border gate in terms of tourism has brought Aydın city as one of the most developed cities of the sector. Because the west side of Aydın opens to Aegean sea, Kuşadası and Yenihisar districts are suitable for every area of tourism and other districts are more suitable for folkloric and archaeological values as daily visits. Thus, the investments are accumulated in these two coastal districts and prospective requests intensify on this area. Another importance of Aydın is to be very close to İzmir metropolitan area and it is directly within the impact area. Aydın city centre, that is 100 km away from İzmir via the highway connection, is 930 km away from Istanbul and 530 km away from Ankara. Sea way is provided from the Kuşadası port within the city and İzmir port is used for the usage of a larger port.

²⁶Aydın Metropolitan Municipality, aydin.bel.tr, January, 2017.

Railway is the first railway line of Turkey besides the Aydın-İzmir line and it passes through the Söke extension. Menderes airport is on the Aydın-İzmir highway and it provides service to Kuşadası and Didim besides Aydın and İzmir. Climate suitability in Aydın and providing opportunity to a long tourism season are the most important encouraging factors. In Aydın city, where Mediterranean climate is dominant; warm months are more. At the same time, the temperature of the sea water provides water sports and swimming opportunities in half of the year covering May-October months. Also, the residing people within the city and the people coming from close cities benefit from the public beaches daily or on weekends.

This kind of usage is quite common due to the accessibility and climatic properties. This demand is mostly from Söke, Nazilli and Aydın cities. There is a difference between the west and east sides of Aydın in terms of tourism. West side is an area where the resources providing service to domestic and foreign tourism are opened for usage and required interventions for the potential ones are done in order to open them for usage. East side mostly provides service to domestic tourism. However, the archaeological sites and the diversities that will be created may cause the foreign tourism to be intensified in this region. Due to the tour routes including Aphrodisias and Pamukkale, east of the city can be used by foreign tourism. Apart from the coastal and archaeological sites; health tourism (thermal), historical and architectural works, archaeological sites, museums, traditional hand arts, regional fests, camel wrestling, cultural tourism, sportive tourism, trekking, riding, golf, scuba diving, sea and land hunting, swimming, sailing, water sports etc. sportive tourism are the activities having the potential to be developed in the city.

Cultural Tourism

Aydın province is one of Turkey's richest regions in terms of archaeological sites. This city which has been a part of Hittite, Ionian, Lydian, Roman, Byzantine, Anatolian Seljuks, Aydınoğulları, Menteşoğulları and the Ottoman Empire since the end of the 4,000 BC until the present day, has a great potential in terms of domestic and especially foreign tourism with its ancient cities and museums it has. Miletus, Didyma, Priene; Alinda and Alabanda in the centre south, Tralleis, Nyssa in the north and Aphrodisias in the east and İzmir, Ephesus and the House of the Virgin Mary in the east, Hierapolis in Denizli in the east, the ancient cities of Labranda, Lasos and Halikarnassos in Muğla in the south, the historical and archaeological excursion areas create a demand for tourism.

Mosques in the city centre and Arpaz Castle in Nazilli, Körteke Castle in Bozdoğan, Cincin Castle in Koçarlı, mausoleums, madrasas, masjids and baths, shall provide a different perspective to the tourism in the city through making the required restorations in these buildings and promoting them and by encouraging visits to Seljukid and Ottoman period buildings besides archaeological sites of Roman and Ancient Greek periods. Other attractive elements in the province, which can create tourism demand, include the old urban textures, historical residential buildings, festivals, authentic rural settlements, traditions, weaving looms, camel wrestling, picnic and recreation areas in forest and highlands.

Kirazlı village near Kuşadası, which is one of the interesting rural settlements, attracts tourists with its architectural texture as well as carpet and weaving looms, local food such as pastry (sac böreği) and ayran, and the nearby Lion Cave. Old Çine is an important historical settlement with its architectural texture, 14th century Ahmet Gazi Mosque and Ahi İbrahim Mausoleum and rock tombs and ruins and hand-woven crafts around Asarlık. In addition, the traditional clay tents of Turkmens are produced in the Olukbasi village of Bozdoğan district between Aphrodisias, Neopolis and the works are being carried out in order to offer local dishes with authentic clothes in these tents. The festival and especially the camel wrestling, which are generally made outside the tourism season, are mostly attended by local people and domestic tourists. Camel wrestling, albeit in a limited number, attracts the attention of foreign tourists. In addition, Sultanhisar, Nazilli, Ortaklar, Germencik, Incirliova, Kuyucak and Köşk railway station buildings are examples of the 19th century economy and transportation history.

Health Tourism (Thermal)

There are small and large thermal facilities in Aydın. There are 6 thermal facilities in the region which are Alangüllü (Bozköy), Ömerli and Gümüş (Gümüşilica) in Germencik; Davutlar in Kuşadası, Salavatlı and Buharkent in Sultanhisar. Alangüllü Spring: It is in Germencik district Bozköy area. There is a facility with 32 rooms and 70 beds capacity and indoor thermal pool licenced by the municipality. In addition, the cure facility and modern thermal and accommodation facilities have been built by the Special Provincial Administration and it has become one of the most modern and large thermal springs in the region. Gümüşköy Spring: It is in Germencik District Gümüşköy area. The Gümüş Thermal facility is a very small facility with 2 rooms and 4 beds. Davutlar : There is a private facility without accommodation service in around the hot spring area in Kuşadası district, Davutlar town settlement. Salavatlı hot spring: It is in the west of Sultanhisar. It is currently active.

Sportive Tourism

Among the water sports and sea sports made in Aydın Province, swimming, diving, sailing, surfing, water parachuting and water skiing and also spear fishing or fishing from the shore-boat are made. Among these sports swimming, surfing, water skiing and parachute, as well as recreational activities such as pedalo, banana skiing are made in bays where beaches used by public in the settlements and even in touristic facilities. Special diving areas are determined in terms of underwater diving and tours are organized in groups in these areas and supervised diving sessions are carried out for observing these sites. There are areas with natural features such as old sunken ships, amphorae or seals, coral reefs for this purpose.

II.3.4. Other Issues

Within the scope of the project, there is no other matter to be added except the information given in the above sections.

SECTION III

ENVIRONMENTAL IMPACTS AND MEASURES TO BE TAKEN DURING CONSTRUCTION AND OPERATION PHASES OF PROJECT

SECTION III: ENVIRONMENTAL IMPACTS AND MEASURES TO BE TAKEN DURING CONSTRUCTION AND OPERATION PHASES OF PROJECT

(In this Chapter, the Effects of the Project on Physical and Biological Environment, Legal, Administrative and Technical Measures to Be Taken to Prevent, Minimize and Improve These Effects are explained separately and in detail for Titles III.1 and III.2)

The possible impacts of the activities to be carried out during the construction and operation phases of the planned project are explained in detail and measures to be taken in order to minimize or prevent these effects are elaborated below.

III.1. The Effects of the Project during the Preparation of Land and Construction Phases on the Physical and Biological Environment and Measures to be Taken**III.1.1. The Locations And Size Of The Lands For The Excavated Soil And Topsoil Removed Within The Scope Of The Preparation Of Land, Amounts Of Excavated Soil And Topsoil, Materials To Be Used, Explosive Substances; Information, Impacts And Measures To Be Taken Regarding Explosion, If Any, Where To Transport The Materials Such As Excavation Waste Soil, Stone, Sand And Topsoil, Where To Store Them, The Scope Volume And The Purposes For Use, Organization And Restoration Plan For Excavation Material, Opinions To Be Taken And Characteristics Of The Temporary Storage Area**

Within the scope of the Efe-7 Geothermal Power Plant project, the area of 32,283,345 m² in Aydın Province, Germencik District, Mesudiye Neighbourhood, Seyrekkovalık Site lot 141, block number 121, 133, 119, 97, 102 and lot 245, block number 147 will be used.

Within the scope of the land preparation and construction works for the project, site levelling works, foundation excavations of the structures, construction of the structures, coarse and fine production constructions, machine and equipment placement, heating, ventilation and plumbing installations and as the last stage, landscaping works will be carried out.

Amount of Topsoil

Within the scope of the project subject activity topsoil of 20 cm thickness shall be stripped gradually before starting the construction activities and it shall be stored in a place which does not have more than 5% inclination according to the "Excavation Soil, Construction And Wreckage Wastes Management Regulation" and shall be used in the landscaping works of the site. Any crushing and grinding process shall not be carried out in removing the topsoil. The remaining part of the topsoil apart from that can be used within the scope of the project shall be transported to the area shown by Germencik Municipality.

Amount of Topsoil to Occur = Construction Area x Topsoil Depth Amount of

Topsoil to Occur = 18,339 m² x 0.20 m

Amount of Topsoil to Occur = 3,668 m³

If the density of the topsoil is considered as 1.6 ton/m³;

Amount of Topsoil to Occur = 3,668 m³ x 1.6 ton/ m³

Amount of Topsoil to Occur = 5,869 ton

Amount of Excavation Soil

The project area is a plain land and after soil stripping, excavation will be carried out.

Table 60. Approximate Area To Be Covered by the Units and Approximate Excavation Soil to Occur

Unit	Area (m2)	Depth of	Amount of
Power Plant	7,500	0.5	3,750
Injection Station - Brine Volume Tank	75	0.75	56.25
Injection Station - Brine Injection Pump	180	4.0	720
Switchyard	600	1.0	600
Pentane Tank	130 x 2	1.0	260
Administrative building	300	1.0	300
Total			5.686 m ³

5.686 m³ of excavation will be carried out in the project area. The General Settlement Plan showing the operating units and their locations is given in Annex-7.

Within the scope of the planned project, pool, switchyard and workshop use will be provided from Efe-2 Geothermal Power Plants operating at north of Efe-7 GPP project site and a separate pool will not be built within the scope of Efe-7 Geothermal Power Plant project.

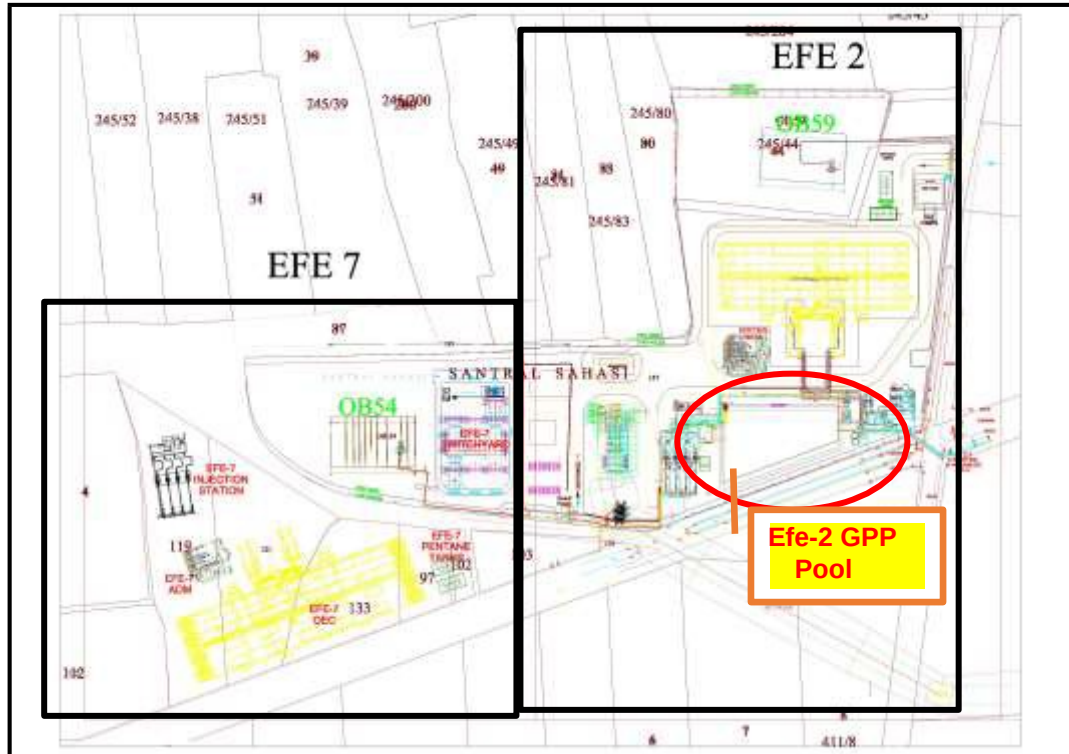


Figure 90. Planned Uses

Within the scope of the project, construction works to be carried out in the plant area are planned to be completed in 8 months, 25 days a month and 12 months in a day.

The excavation surplus material to be removed from the activity site will be accumulated in a suitable place in the site and then reused in the landfill and land smoothing works.

The provisions of "Excavation Soil, Construction And Wreckage Wastes Management Regulation", which entered into force after being published in the Official Gazette dated 18.03.2004 and numbered 25406, shall be observed in all excavation works to be carried out within the scope of the project.

III.1.2. Transportation, Storage And Uses Of Flammable, Explosive, Dangerous, Toxic And Chemical Substances That Will Be Used During The Preparation Of The Land and also for the Construction of the Units; Tools and Machines to be Used for These Works; Types And Properties Of Fuels To Be Used In These Tools And Machines, Emissions To Occur, Measures To Be Taken

Within the scope of the construction phase of the project, which is planned to be realized, no flammable, explosive substances will be used. Construction equipment will be used for the work to be done. The construction equipment to be used are given in Table.61.

Table 61. Planned Machine-Equipment List for Construction Site

MACHINE-	NUMBER
Excavator	1
Loader	1
Truck	4
Road roller	1
Concrete Truck	1
Concrete Pump	1
Diesel Engine Crawler Crane	1

Emission Formation by Construction Equipment

Diesel Fuel will be used in the construction equipment such as excavators, trucks, loaders etc. during preparation of the land and stripping of the topsoil within the scope of the project. The diesel fuel will be supplied from the nearby fuel stations and the specifications of the diesel fuel are given in the table below.

Table 62. Diesel Fuel Specifications

PARAMETER	UNIT	VALUE
Density (at 15°C)	Kg/m ³	820-845
Flash point	°C	55
Cold filter plugging point - winter	°C	-15
Cold filter plugging point - summer	°C	5
Sulphur	Mg/kg	10
Carbon residue (over 10% residue)	% (weight)	0,30
Fluidity (at 40°C)	cSt	2-4.5
Ash	% (weight)	0.01
Cetane index	-	46
Water	mg/kg	200
Particle Matter	mg/kg	25
Oxidation stability	g/m ³	25

Daily fuel consumption of construction equipment is calculated by using the following formula and given as a table.

$$\text{Fuel Consumption} = \text{Engine Power (Hp)} \times 0,18 \text{ (lt/Hp)}$$

The amount of emissions from the fuels to be used in the vehicles within the scope of the project varies according to the type, age, maintenance, speed and work to be done in the field and average emission factors were determined for these types of vehicles considering all these factors. These emission factors determined by EPA are given in Table.63.

Table 63. Emission Factors (Mobile Sources Emission Factors, EPA, 1995)

PARAMETER	LIGHT CONSTRUCTION EQUIPMENT	HEAVY CONSTRUCTION
HC (g/km)	0.181	1.313
CO (g/km)	0.719	5.95
NOx (g/km)	0.544	4.056

The mass flows of the total emissions to be emitted from the vehicles to be operated within the scope of the project was calculated with the assumption that 3 light construction equipment/vehicle will be active, and the speed of the vehicle will be 40 km/hr and both these values and the "SKHKKY" (Industrial Air Pollution Control Regulation) limit values in Annex-2, Table 2.1. are provided in Table.64.

Table 64. Total Mass Flow Values Of Emissions from the Vehicles to be Used Within the Scope of the Project

PARAMETER	MASS FLOW (g/hr)	MASS FLOW (kg/hr)	LIMIT VALUES GIVEN IN SKHKKY ANNEX-2, TABLE 2.1. (kg/hr)
HC (Hydrocarbons)	21.7	0.022	-
CO (Carbon monoxide)	86.3	0.09	50
NOx (Nitrous oxide)	65.3	0.07	4

As seen in Table.63; since the total amount of emissions generated by the vehicles is well below the limit values given in Table 2.1 of Annex 2 of the "SKHKKY", there is no need to determine the total pollution values. Therefore, emissions from vehicles are not expected to have a significant impact on the current air quality.

In the land preparation stage of the project, the provisions of "Exhaust Gas Emission Control and Gas and Diesel Quality Regulations" shall be complied with.

In addition, in order to minimize the emissions from the vehicles to be used in the land preparation phase, all the vehicles and equipment to be used will be routinely controlled and the vehicles which require maintenance will be maintained and other vehicles will be employed until their maintenance are completed.

Formation of Hazardous Waste

Contaminated packages, oakum, contaminated working clothes etc. which is possible to occur during construction phase of the project can be regarded as hazardous waste.

In case of formation of wastes within the scope of hazardous waste during the construction phase, these wastes will be separated according to their types, sealed and stored in temporary waste storage area which will be constructed to have sections for each type of waste. In each section of the temporary waste storage area to be constructed, there will be signs containing information (name, waste code, etc.) to identify the wastes to be stored.

Sending the hazardous wastes to the recovery / recycling facilities licensed by the Ministry of Environment and Urbanization and their disposal will be ensured within 6 months of temporary storage duration without delay. Later, a copy of the form A of the UATF documents shall be submitted to the Ministry of Environment and Urbanization and a copy of the form D shall be submitted to the Provincial Directorate of Environment and Urbanization of Aydın and one copy from B and D forms will be archived and kept for at least 5 years.

In addition, the provisions of the "Waste Management Regulation", which was enacted after being published in the Official Gazette dated 02.04.2015 and numbered 29314, shall be complied with for hazardous wastes likely to occur in all stages of the project.

Waste Batteries and Accumulators

Since the maintenance and repair of the vehicles and equipment to be used within the scope of the construction of the project will be carried out at authorized service stations outside the activity area, the battery changes will also be made outside the plant. Waste accumulators to occur will be given to the service station where the new accumulator is purchased.

However, in the event of any battery changes in the plant in case of an emergency, the waste accumulators possible to occur shall be stored in a sealed indoor environment temporarily and their disposal will be ensured by giving them to a recovery/recycle company licenced by the Ministry of Environment and Urbanization in accordance with the provisions of "Waste Battery and Accumulator Control Regulation" (Amended: R.G.-03.03.2005/25744, R.G.-30.03.2010/27537, RG-5.11.2013-28812, RG-23.12.2014-29214) enforced by being published in the Official Gazette dated 31.08.2004 and Numbered 25569.

Provisions of the "Regulation on Regular Storage of Waste" (Amended: RG: 11.03.2015 – 29292) enforced on 01.04.2010 by being published in the Official Gazette dated 26.03.2010 and numbered 27533 and "Waste Battery and Accumulator Control Regulation" (and all the amendments to the regulation) enforced by being published in the Official Gazette dated 31.08.2004 and Numbered 25569 shall be complied with during the construction phase of the planned activity.

Medical waste

Medical equipment capable for performing immediate treatment in case employees, who will work in the construction phase, have an accident will be stocked and since no medical interventions such as injection or suture will be performed, there will not be any cutting-puncturing medical waste. In case of more severe injuries and accidents, the person will be immediately sent to the health facilities located in the nearest settlements. In this context, although the amount of wastes in the plant cannot be determined, it is estimated that there will be a very small amount.

All medical wastes that may occur in the infirmary unit; shall be placed in red coloured plastic which are resistant to puncturing, tearing, exploding; made of original medium density polyethylene raw material, leak free, with double bottom seam, with capacity to carry at least 10 kg and with double layer thickness of 100 micron, made without bellow, with "International Biohazard" emblem and "ATTENTION! MEDICAL WASTE" written on them. The bags shall be filled maximum to $\frac{3}{4}$ level, and their openings shall be tightly tied and in case deemed required, each of the bags shall be placed in another bag with the same specifications to provide sealing. The contents of the medical waste bags will not be compressed in any way, the medical wastes will not be removed from the bag, unloaded and transferred to another container.

Wastes with cutting-puncturing features shall be separated from other wastes and placed in plastic or laminated cardboard box which are resistant to puncturing, tearing, cracking, exploding and which are water resistant and leak free, impossible to open and touch the contents, with "International Biohazard" emblem and "ATTENTION! SHARP MEDICAL WASTE" written on them or containers with same specifications. These storage containers shall be filled maximum to $\frac{3}{4}$, and they shall be closed and put in medical waste bags. After the cutting-puncturing waste containers are full, they shall not be compressed, opened or emptied.

The provisions of "Medical Waste Control Regulation", which entered into force after being published in the Official Gazette dated 25.01.2017 and numbered 29959, shall be observed in all phases of the project.

III.1.3. Transportation Infrastructure Plan Within the scope of the Project, Distance of the Project Area to Highways, Link Roads to the Highway, Measures to be taken for Preventing Damage to the Current Roads to be Used for Transportation and Measures to be Taken In terms of Traffic Safety (Opinions, Permits to be Taken In this Context)

Transportation to the activity area is by highway. Access to the planned project area will be provided by available roads.

During the construction phase of the project, speed limits will be complied with. During transportation, the carriers will be covered with a tarpaulin and some measures such as humidification of roads will be taken, and the necessary sensitivity will be shown in order to minimize the impact of emission due to transportation on the roads.

Highway Traffic Law No: 2918 and all laws and regulations published in context of this law in force depending on this law will be complied with during transportation.

Traffic Volume Load Map 2015 of General Directorate of Highways, Directorate of Strategy Development, Directorate of Transportation and Finance Studies Department is given below.

Within the scope of the project, all transportation will be made in the existing roads and if necessary, new roads may be opened or existing roads can be improved.

All the vehicles and equipment to be used will be routinely controlled and the vehicles which require maintenance will be maintained and other vehicles will be employed until their maintenance are completed and works will be carried out in compliance with the Highway Traffic Law and especially loading hauling operations will be done in accordance with loading standards.

Within the scope of the planned Efe-7 Geothermal Power Plant project; the opinion of 2nd Regional Directorate of Highways will be taken, and an application will be made to the Aydın Metropolitan Municipality, Transportation Department Directorate by submitting the necessary documents for issuance of Passageway Permit Document in terms of ensuring security during vehicle entrances-exits from the mentioned blocks.

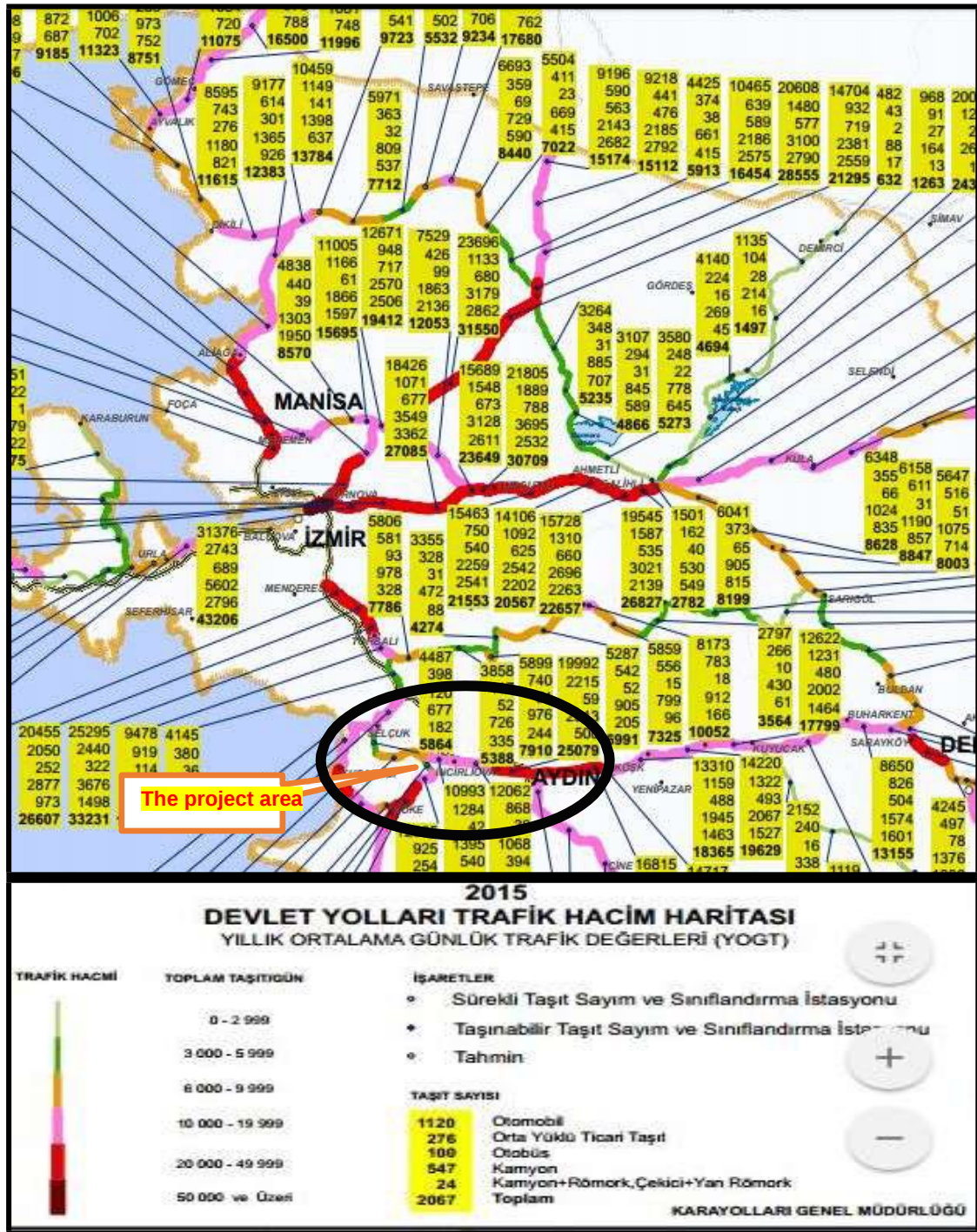


Figure 91. Highway and State Road Traffic Volume Map

Source: 2015 Traffic and Transportation Information

Annual Average Daily Traffic Values and Transportation Data according to Traffic Sections of Highways and State Roads, Directorate of Strategy Development Department of Transportation and Cost Studies Department, 2017

The provisions of Traffic Law numbered 2918 and "Regulation on Facilities To Be Established and Opened Near Highways" issued with regard to this Law shall be complied with for passageways in case they are built on cadastral fields, neighbourhood and district roads within the scope of the project.

During the construction phase, no permanent damage shall be given to the roads under the duty, authority and responsibility of Aydın Metropolitan Municipality and necessary applications will be made and permits shall be obtained regarding compensation of transportation damages to be given to relevant neighbourhood roads by the investor company.

In case of any excavation on the same roads, necessary permits and licenses shall be obtained.

In case the construction vehicles use the local roads, no permanent damage shall be given to the infrastructure and superstructure of the roads and necessary applications will be made and permits shall be obtained regarding compensation of transportation damages to be given to relevant neighbourhood roads by the investor company.

Regarding the Project, the permit processes shall be completed by making the necessary applications to the Ministry of Energy and Natural Resources and Energy Market Regulatory Authority (EPDK) within the scope of "The Law Related to the Usage of Renewable Energy Sources for Electrical Energy Generation Purpose" numbered 5346, "Electricity Market Law" and other relevant legislations

III.1.4. Possible Effects On Physical Environment During Drilling To Be Performed Concerning The Usage Of Geothermal Resource, Number Of Wells To Be Opened, Information About How Many Of These Will Be Used For Reinjection Purpose, Installation Of Drilling Equipment, Roads To Access Well Head And Effects On Surface Morphology In This Area And Local Plant Cover And Natural Life And Measures To Be Taken,

Drilling operations take approximately two months to complete a well. Rotary drilling technique is used in these operations and the resource is reached by means of tricone roller bit drilling machines. The diagram showing typical rig for drilling is given below.

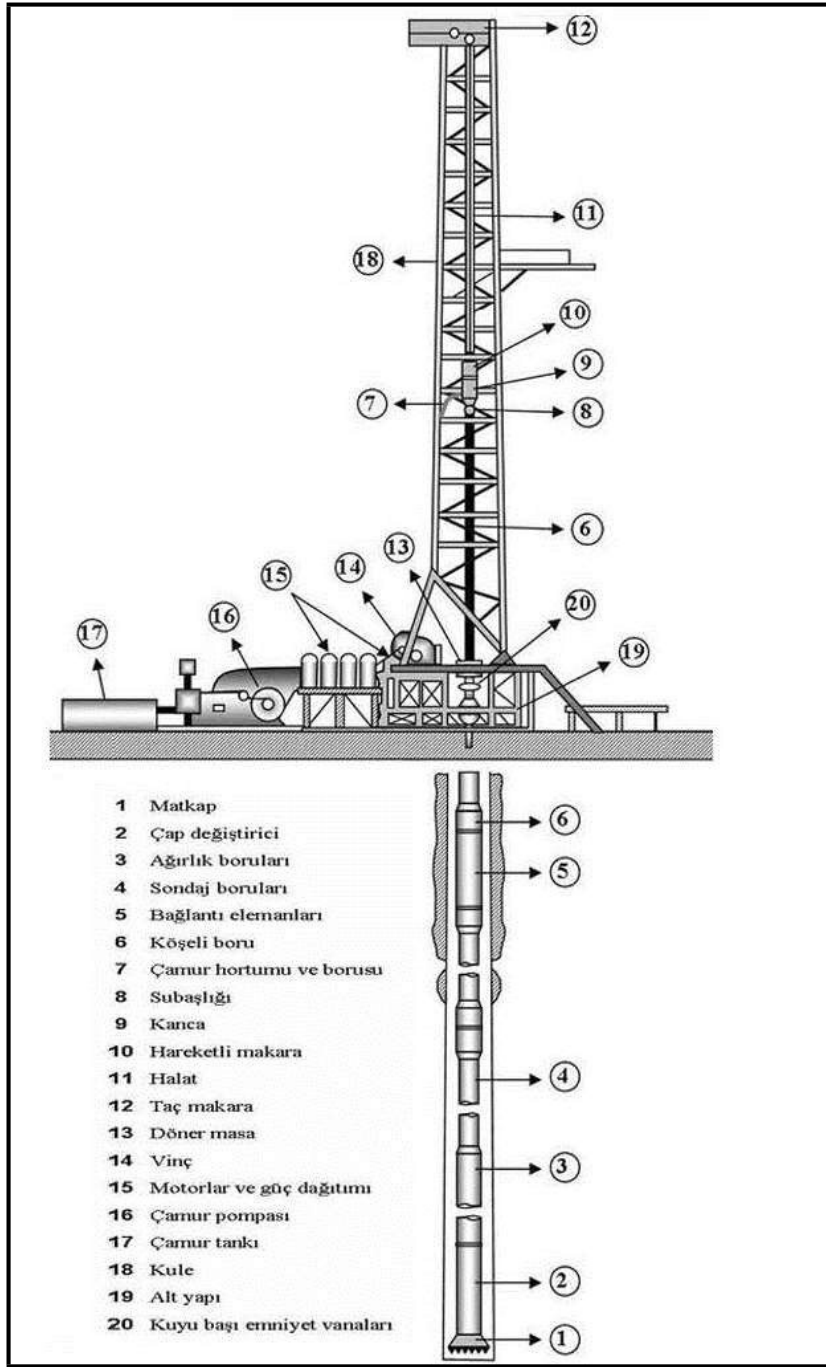


Figure 92. Typical Drilling Rig

A total of 15 wells will be used for production and reinjection within the scope of the project. 10 of the wells will be used for production and 5 of them will be used for reinjection. In existing wells, only piping works will be carried out and piping works will be made in well to be drilled new will be made after the drilling work.

In relation to the drilling to be carried out, the drilling rig is seated on the determined area and this area is covered with bentonite. During drilling, a mud pond will be formed on the ground and the material formed during drilling will be taken to this pond. Mentioned ponds covered with impermeable membrane will be formed around the wells for the drilling mud. A representation of mud pond is given in Figure.93.



Figure 93. Mud Pit

A small amount of excavation waste will be generated during drilling wells. The excavation to be formed will be stored at one point of the drilling area. After the drilling process is completed, part of the excavation will be used for filling the mud pond. Excavation wastes that are not possible to be utilized will be disposed of by transporting to waste disposal sites of Germencik Municipality and/or Aydın Metropolitan Municipality if present.

Information on the production and reinjection wells planned to be used within the scope of the project is given in the table below.

Table 65. Production and Reinjection Well Information

	Item	Well Name	Status
Production Wells	1	OB-50	Availab
	2	OB-50A	Availab
	3	OB-50B	Availab
	4	OB-50C	Availab
	5	OB-103A	Availab
	6	OB-103B	Availab
	7	OB-94A	Availab
	8	OB-94B	Availab
	9	OB-94C	Availab
	10	OB-94D	Availab
Reinjection Wells	1	OB-57	Availab
	2	OB-61	Availab
	3	OB-67	Availab
	4	OB-56A	New
	5	OB-56B	New

The satellite image of the production and reinjection wells planned to be used within the scope of the project is given in Figure.94.



Figure 94. The satellite image of the production and reinjection wells planned to be used within the scope of the project

The leakage on the ground will be filled by using Bentonite and an impermeable layer will be achieved during the drilling works. The ground is tightened by filling the cracks on the ground. Bentonite is a non-hazardous chemical and Material Safety Data Sheet (MSDS) is given in Annex-16. In order to remove the cut-off pieces, fresh water-based polymer mud is used. Main components of the drilling mud are water and bentonite

The amount of drilling mud may vary according to drilling depth, geological structure and atmospheric conditions. The need for drill mud increases since drill bit is more worn away when drilling is made on competent rocks, the need for drill mud may also increase in order to ensure stabilization of the drill hole when drilling is made on geological units with fragmental texture. For these reasons, although it is not possible to give the amount of mud to be generated during drilling, it was revealed that the pond will be sufficient regarding the works carried out by the investor before. The bottom of the mud pond will be inclined towards the suction point, the waste mud stored in the pond will be left to rest and the solids will settle to the bottom.

During the operation, discharge of the mud out of the pond will not be allowed, no solid or liquid waste related to drilling mud and drilling wastes will be discharged to the creek beds. Security measures will be taken by surrounding the mud pond with fence and placing caution signs.

During the operation, discharge of the mud out of the pond will not be allowed, no solid or liquid waste related to drilling mud and drilling wastes will be discharged to the creek beds.

For the wells to be used within the scope of the project, the well permits given by Aydın Governorship, Investment Monitoring and Coordination Department, Natural Resources License and Cultural Property Directorate are given in Annex-20 and the representation of these wells on the map is given in Annex-19.

Additional tests on wells will be carried out, additional geophysical surveys will be carried out to determine the site potential and additional wells will be drilled after identification of new locations and work will be carried out to develop the plant. When a geothermal borehole is planned to be drilled, necessary permits shall be obtained from relevant institutions and organizations within the framework of other applicable legislation for each borehole.

III.1.5. Possible Impacts to Groundwater During Drilling of Geothermal Borehole and Construction of Other Units, Measures To Be Taken Regarding Mixture Of Groundwater And Drill Fluids While Passing Through The Potential Aquifers

The area where the project site is planned to be realized shows a fertile aquifer characteristic in terms of groundwater. The geothermal fluid to be used in the plant comes from reservoir rocks and there are seal rock units formed on the reservoir rocks. In this context, hydrogeological systems can be positioned differently and separately.

It is important that the water of these two systems, which are different from one another, are not mixed with each other, and the geothermal resource coming to the power plant and used in it, shall come to the power plant in a completely closed system and shall be reinjected back to the underground after use. In addition, casing pipes will be used during well drilling, mixture of groundwater and drilling fluids with potential aquifers will be prevented. In this context, there will be no mixture or negative impact on groundwater caused by the operation.

In case of a technical problem which may cause geothermal fluid mixing in the production and reinjection wells, measures will be taken immediately to prevent the mixing of the geothermal fluid into the groundwater and the organizations and institutions will be informed as soon as possible.

The production and reinjection wells planned to be drilled within the scope of the project will only be constructed in such a way as to enable production and reinjection in metamorphic series.

In the operations within the scope of the project under "Regulation on the Protection of Groundwater Against Pollution and Degradation", it will be observed that waste waters shall not be discharged to the groundwater regardless of its quality, necessary measures will be taken during well test and maintenance/repair in order to modification of natural, physical, chemical and ecological characteristics of the basin due to discharge of the test fluid.

During the works to be carried out within the scope of the project, provisions of Law on Groundwater, Regulation on the Protection of Groundwater from Contamination and Degradation, Regulation on Control of Water Pollution shall be observed.

In addition, During the construction and operation phase, material and waste shall not be dumped into the surrounding creek beds, no harm will be made to the existing flood protection structures, no activity shall be carried out influencing the flow of the creek and the provisions of the Prime Ministry Circular on "Creek Beds and Floods" numbered 2006/27 will be observed.

During all drilling activities planned to be carried out within the scope of the project, necessary measures will be taken to ensure that cold groundwater aquifers are not harmed.

III.1.6. The Amount Of Mud To Be Generated In The Drilling, How To Dispose Of It After Use, Operations To Be Implemented Regarding Cleaning Of The Mud And Separating It From The Fluid

During the drilling operations to be carried out within the scope of the project, drilling fluid will be used. Chemicals such as bentonite, barite and caustic soda will be used in the drilling fluid and drilling mud to be generated will be collected in the leak-proof mud ponds next to the drilling area.

Drilling mud is used for various technical reasons. Removing the pieces and crumbs of rocks drilled in the underground and keeping the bottom clean enable the drill to be made easily. The faster the rock crumbs are removed from the base, the sooner the drilling will proceed.

Lubrication and cooling of drill and drilling tools: The heat generated during the operation of the drill in the well bottom is cooled by the circulating mud. In addition, the mud plays a lubricating role by covering the surfaces of the rods, the well wall, the surface of the casing pipes, the wear parts of the pumps and the drill bearings as a thin film.

Preventing collapse and sink: During drilling, in order to prevent the formations cut in the well to collapse and sink into the well pit and lead to closing of the well, it shall have a higher pressure than the one of the formations. Especially the mud entering into the sand and gravel layers consolidates them by fixing them.

Generation of an impermeable pie: Due to hydrostatic pressure, drilling mud adheres to the well wall and forms a mud pie. This leads to the mud pie impermeability. If the mud is in good quality, the thickness of the pie will be less as the filtration water will be less. Thus, the well will not become narrow and the drill string will work more easily.

Keeping the bearing pressure under control: If the hydrostatic pressure in the wells is less than the formation pressure, there is a danger that the water in the formation will flow into the well and rise upwards. In this respect, the density of the sludge must be increased to a value that prevents the emanation.

In accordance with the provisions of the "Regulation on Regular Storage of Waste" the waste type will be determined by having them analysed in an accredited and/or competent laboratory. During the operation, discharge of the mud out of the pond will not be allowed, no solid or liquid waste related to drilling mud and drilling wastes will be discharged to the creek beds. Security measures will be taken by surrounding the mud pond with fence and placing caution signs.

III.1.7. Actions related to erection of the pipeline to be used for transportation of geothermal fluid and its potential impacts on the surface, precautions to be taken

In the scope of the project, to transport geothermal fluid to the power plant area and to transport the fluid used for energy generation from the power plant to the reinjection wells, pipelines must be laid between the well locations and the power plant building. These pipelines will be placed on the ground every 10 m in a way that does not affect the irrigation canals in the region and will be mounted on the feet of a minimum diameter of 90 cm.



Figure 95. View of the Existing Piping System

The pipeline to be constructed from the beginning of each well to the power plant site is to be taken from the Earth and no excavation or filling is planned for the installation of the pipeline. In this context, the formation of the excavation is not expected. The pipeline route will be determined after the well tests to be carried out following the completion of the production and reinjection drilling. In order to ensure the sustainable use of the resource, the quality of the reservoir feed and whether or not it will be operated will be determined according to the results of the well test to be carried out after the drilling is completed. After that, the route will be determined by taking into consideration the earthquake loads for various transitions depending on the terrain situation.

The carbon steel pipes which are insulated with polyurethane for the pipelines are used and, if necessary during the application, reinjection pipes can be laid under the ground following obtaining the necessary permits.

The outside of the pipes to be used in the transportation of geothermal fluid will be insulated, thus preventing any heat loss from the geothermal fluid flowing through it, preventing the decrease of energy efficiency at the same time, and also preventing the natural environment along the pipeline from being affected negatively by the geothermal fluid.

Due to the pipeline to be constructed between the production and reinjection wells and the power plant building, it is not expected that the surface will be adversely affected along the natural environment and pipeline route. The pipes to be laid will be brought to the project area ready, and there, the installation and footing will be carried out. The loss of terrain for the pipeline is only possible to mention the very small amount of soil loss in the area where the feet will be set. When the pipeline route is made after leaving the well location, the loss of agricultural area will be minimized by passing through the boundaries of agricultural lands and cultivated areas.

It is planned to make omegas at certain distances in the pipeline installation. Thus, in case of expansion and contraction in the pipeline, the pipeline will not be broken or leakage will be prevented.

The chemical substances will be dosed into the fluid to prevent the formation of lime in the turbines at the well heads, which are bored within the scope of the project, at pipe system and power plant building. The dosing will be carried out automatically and will be provided by the introduction of the special chemical prepared on the surface to the bottom of the well by means of the fine pipes to be lowered into the inside of well from the well head. This will prevent calcification on the inner surface of the pipes. Thus, any clogging of the pipes will be prevented and pipe fracture and low efficiency will be prevented. Maintenance, repair and similar activities to be performed on the transmission line will be kept to a minimum. In this way, the intervention to the natural environment and surrounding agricultural lands will be reduced.

Since the planned pipelines will not be fixed on the soil surface, animal passages will not be affected negatively by the pipeline. Due to the fact that the pipes to be used will be thermally insulated, it is not expected that the surrounding plants, animals or people will be adversely affected by the heat of hot geothermal fluid flowing through the pipes.

III.1.8. Flood study for the project site, Where and how to perform flood prevention and drainage operations; Procedures of ground safety (Bearing capacity of the plant in case of unique formations such as earthquake, landslide, avalanche, flood, rock-fall, measures to be taken, allowable stress, settlement calculations)

The most important surface water around the project area is the Menderes River, which is about 6 km away from the project area and the Çamurluölü Stream located at a distance of 300 meters. The rivers with seasonal flow, which can cause floods during rainy times for the project area and its surroundings, and the high groundwater level are controlled by irrigation and drying canals in the region, and reaches the Büyük Menderes River. All necessary measures shall be taken by the activity owner against the risk of a flood that may occur with seasonal rainfall.

While the foundation pit is being excavated during the construction, necessary pumping measures will be taken by taking into consideration that the surface waters in the sand-gravel layer and the perched waters can reach to the foundation.

Rain-water extraction will be provided through the rain-water extraction system to be established around the facility area. The rain-water extraction system will be designed according to the maximum rainfall values, which are observed at the standard times, which are measured by Aydın Meteorology Station. Rain-water will be disposed of by sending to the facility's balancing pond. No action shall be taken against the risk of flood in the facility area without taking all measures.

If road crossing (bridge, culvert, etc.) is made on the riverbed, necessary permits will be obtained from DSİ Regional Directorate.

The relevant provisions of the Prime Ministry Circular No. 2006/27, published on 09.09.2006 with the name of 'Riverbeds and Floods', shall be complied with. The investor company shall be liable in the case of any possible floods and for damages due to non-compliance with the foregoing issues and the damages will be incurred by the investor company.

During the works to be carried out within the scope of the project, the Law on Groundwater, the Regulation on Protection of Groundwater from Contamination and Degradation, which was dated 7 April 2012 and numbered 28257, and the provisions of the Regulation on Water Contamination Control will be followed.

Since the project area is located in the 1st degree hazardous earthquake zone, all the construction works within the scope of the project; The Regulation on the Buildings to be Constructed in Earthquake Zones, which is entered into force after being published in the Official Gazette No. 26454 dated 06.03.2007 and the provisions, which are amended in this Regulation, published in the Official Gazette no.26511 and dated 03.05.2007.

In the application phase, according to the ground survey report, the quality, basic type, basic depth and the engineering parameters (stability analysis, swelling, sitting, bearing power, etc.) of the level to be beared will be determined and all interpretations and calculations will be made in detail.

The Geological-Geotechnical Survey Report of the Project area is presented in Annex-15.

All construction measures to be taken for the geological risks specified in this section and the results and recommendations sections of the geological-geotechnical survey report, which is prepared for the project area and the basis of the zoning plan shall be complied.

III.1.9. Dust spreading operations such as crushing, grinding, washing-screening, transportation and storage during construction, cumulative values, measures to be taken

Within the scope of the Efe-7 Geothermal Power Plant project, a total area of 32.283,345 m² shall be used on parcels numbered 141 Island 121, 133, 119, 97, 102 and 245 Island- parcel no. 147, which are belong to Aydin Province, Germencik District, Mesudiye Neighbourhood, Seyrekkovalık Locality.

Terrain preparation and construction works for the project will include site leveling operations, foundation excavation and construction of buildings, construction of coarse and fine manufacturing, installation of machinery and equipment, installation of heating, ventilation and sanitary installations, and finally landscaping. Therefore, dust emission from the construction period will occur during the operations carried out at the construction site. The calculations of dust emissions are given below.

Dust emission during the production, unloading and transportation operations during the construction works was calculated by taking into consideration the dust emission factors given in the Regulation on Control of Industrial Based Air Pollution.

Table 66. Dust Emission Factors

RESOURCES	UNCONTROLLED	CONTROLLED	UNIT
Removal	0,025	0,0125	kg / ton
Loading	0,010	0,005	
Discharge	0,010	0,005	
Shipping (total distance to round trip)	0,7	0,35	/ km-vehicle
Storage	5,8	2,9	st / ha days

Source: 'Regulation on Control of Industrial Based Air Pollution', which entered into force by being published in the Official Gazette dated 03.07.2009 and numbered 27277 (Amended Table: OG-20.12.2014-29211), Annex-12, Table 12.6

Necessary excavations and fillings will be made after the stripping of the soil layer under the project. The construction phase of the project is planned to be completed in a total of 12 months.

Topsoil

Project said activities covered stripped topsoil of 20 cm from the stage as the soil surface prior to starting the construction work "Regulation on Control of Excavation Soil, Construction and Demolition Waste" slope in operation than given in the standard will be stored temporarily in a place with no more than 5%, and field landscape will be used in their work. Any crushing and grinding process will not be carried out while topsoil is stripping. Except for the part of the plant land that can be used in the project, the part that can be used in the project will be carried to the area to be shown by the Municipality of Germencik.

Amount of Vegetable Soil to be Formed = Construction Area x Topsoil Depth

Topsoil Amount = 18.339 m² x 0,20 m

Amount of Topsoil to be Formed = 3.668 m³

If the density of the topsoil is 1.6 tons / m³;

Amount of Topsoil to be Formed = 3.668 m³ x 1.6 tons / m³

Amount of Topsoil to be Formed = 5.869 tons

During the process of dismantling topsoil with work machines, loading it into trucks, transporting it to the farthest point in the project site, discharging it and temporarily storing it, dust emissions are formed and the calculations related to this subject are given below:

Working Hours = 2 months, 25 days / month, 8 hours / day
Hourly Excavation Amount = (5,869 tons / 2 months) / (30 days / month) / (8 hours / day)
= 12.23 ton / hour

In the calculation of dust emissions will occur, the emission factors used, which "Regulation on the Control of Industrial Based Air Pollution", published in the Official Gazette dated 03.07.2009 and numbered 27277 (amended table: RG-20.12.2014-29211) is given in table 12.6. Table V.1.6.1. and the results were evaluated within the framework of the same regulation. The calculations were carried out using "uncontrolled" emission factors, taking into account both the most negative conditions may occur during the dust formation and taking into account the possibility of required control measures were taken and using "controlled" emission factors.

Topsoil Removal + Loading + Discharging Dust Emission Mass FlowUncontrolled;

$$E1 = 12,23 \text{ ton / h} \times (0,025 + 0,01 + 0,01) \text{ kg / ton} = 0,55 \text{ kg / h}$$

Controlled;

$$E1 = 12,23 \text{ tons / hour} \times (0,0125 + 0,005 + 0,005) \text{ kg / ton} = 0,28 \text{ kg / h}$$

Dust Emission Mass Flow in the Transportation of Topsoil

The topsoil taken from the project site will be stored temporarily in the soil storage area to be located within the study area, this distance is average 0.2 km away (round trip).

The mass flow rate of the dust emission during transport will be determined by assuming that each truck that will be used during the transportation can carry 25 tons of material and therefore 2 (25 tons / 12.23 ton / hour) expedition will be carried out in 1 hour;

Uncontrolled;

$$E2 = (0,7 \text{ kg / km}) \times (0,2 \text{ km / 1 time}) \times (1 \text{ time / 2 hours})$$

$$E2 = 0,07 \text{ kg / h}$$

Controlled;

$$E2 = (0,35 \text{ kg / km}) \times (0,2 \text{ km / 1 time}) \times (1 \text{ time / 2 hours})$$

$$E2 = 0,04 \text{ kg / h}$$

Bulk Emission Mass Flow During Storage of Topsoil

An average of 100 m² area will be used for storage of topsoil.

Uncontrolled;

$$E3 = (5,8 \text{ kg / ha-day}) \times (0,01 \text{ ha / 2 months / 30 days/month/8hours/day})$$

$$E3 = 0,00012 \text{ kg / h}$$

Controlled;

$$E3 = (2,9 \text{ kg / ha-day}) \times (0,01 \text{ ha / 2 months / 30 days / month / 8 hours / day})$$

$$E3 = 0,00006 \text{ kg / h}$$

According to this, the total mass flow of dust emission from the stripping of the topsoil to be carried out during the opening of new roads;

Uncontrolled;

$$\text{TOTAL-1} = 0,55 \text{ kg / h} + 0,07 \text{ kg / h} + 0,00012 \text{ kg / h}$$

$$\text{TOTAL-1} \approx + 0,62 \text{ kg / h, as a result.}$$

Controlled;

$$\text{TOTAL-1} = 0,28 \text{ kg / h} + 0,04 \text{ kg / h} + 0,00006 \text{ kg / h}$$

$$\text{TOTAL-1} \approx 0,32 \text{ kg / h, as a result.}$$

Considering that all works to be carried out within the soil stripping operations at the construction site will be carried out in the same time period, the dust emission to be generated is calculated as 0,62 kg / h for the uncontrolled situation and 0,32 kg / h for the controlled situation.

Excavation Amount

The project area is a flat terrain and after topsoil stripping, excavation will be carried out.

5.686 m³ excavation will be carried out in the project area.

The land preparation and construction works of the planned units will not be carried out such as crushing and grinding, and dust emission will be generated from the excavation works to be performed for the foundation pits.

Total amount of excavation (tonnes) = Area x Specific Gravity Total

Amount of excavation (tonnes) = 5.686 m³ x 1.6 ton / m³
= 9.098 tons

The construction work to be carried out in the project area is expected to take approximately 12 months.

Working Hours = 10 months, 25 days / month, 8 hours / day
Hourly Excavation Amount = (9.098 tons/10months)/(25days/month)/(8 hours / day)
≈ 4,55 ton / hour

In the calculation of dust emissions to occur, the emission factors given in Table 12.6 of "Regulation on Control of Industrial Based Air Pollution" published in Official Gazette dated 03.07.2009 and numbered 27277 are used and the results are evaluated within the same regulation. Calculations were made by using 'uncontrolled' emission factors, considering that the most adverse conditions can occur during dust formation.

Dust emission during dismantling, loading and unloading of excavation material:

As a precaution against dusting during loading and unloading; doing slowly of the loading and unloading processes without spinning causing the will cause a slight reduction in the dust output.

Uncontrolled:

E1 = 4,55 ton / h x (0,025 + 0,01 + 0,01) kg / ton = 0.20 kg / h

Controlled:

E1 = 4.55 ton / h x (0.0125 + 0.005 + 0.005) kg / ton = 0.10 kg / h

Dust emission during transport of excavation material;

The excavation surplus material to be removed from the field of activity will be piled in a suitable place in the field and then reused in the basic filling and terrain arrangement works.

The length of the road in which the excavation surplus material will be carried within the project area is 100 m on average. Therefore, the distance to carry the excavation material is 0.2 km from the average (round trip).

Since each truck that will be used during the transport can carry 25 tons of material, it is assumed that there will be 1 expedition in 6 workhours (25 tons/4.55 tons/hour) at the time of operation and the mass flow of dust will be generated during the transport.;

Uncontrolled:

E2 = (0.70 kg / km) x (0.2 km / 1 time) x (1 time / 6 hours) = 0.02 kg / h

Controlled:

E2 = (0.35 kg / km) x (0.2 km / 1 time) x (1 time / 6 hours) = 0.01 kg / h

Dust Emission Mass Flow During Storage of Excavated Surplus Material

The excavation surplus material to be removed from the field of activity will be collected in a suitable place in the field and then reused in the basic filling and land arrangement works. In this context, it is foreseen that an area of 100 m² will be used for the storage of excavation material within the project area;

Uncontrolled:

$$E3 = (5.8 \text{ kg / ha-day}) \times (0.01 \text{ ha / 10 months / 25 days / month / 8 hours / day})$$

$$E3 = 0.000029 \text{ kg / h}$$

Controlled:

$$E3 = (2,9 \text{ kg / ha-day}) \times (0,01 \text{ ha / 10 months / 25 days / month / 8 hours / day})$$

$$E3 = 0,000015 \text{ kg / h}$$

Accordingly, the total mass flow rate of dust emission from excavation works;

Uncontrolled:

$$\text{TOTAL-1} = 0.20 \text{ kg / h} + 0.02 \text{ kg / h} + 0.000029 \text{ kg / h}$$

$$\text{TOTAL-1} = 0.22 \text{ kg / h, as a result.}$$

Controlled:

$$\text{TOTAL-1} = 0,10 \text{ kg / h} + 0,01 \text{ kg / h} + 0,000015 \text{ kg / h}$$

$$\text{TOTAL-1} = 0,11 \text{ kg / h, as a result.}$$

Conclusion and Evaluation

While calculating the dust emission to be generated during the excavation works to be realized within the scope of the construction works of the project, it is considered that the works will be realized under the most adverse conditions. "Regulation on Control of Industrial Based Air Pollution", as specified in Annex 2; for the installations to be established, the "Calculation of the Contribution Value to Air Pollution" is required in case the pollutant mass flow rates, which are specified in Annex-2, are exceeded.

The dust emission that will be generated when all works to be carried out within the excavation procedures are performed in the same time period (worst case scenario) is calculated as 0.22 kg / hour for the uncontrolled situation.

Therefore, as stated in Annex 2 of the SROCOIBAP; for the installations to be established, in case of exceeding the pollutant mass flow rates as specified in Annex-2, an 'Calculation of the Contribution Value to Air Pollution' is not required, by using an internationally-accepted distribution model in facility effect area.

A large part of the excavation surplus material that will be used in the project site will be used in terrain arrangement and the material that cannot be used in terrain arrangement will be taken to the excavation storage area of the Municipality and disposed of. In the excavation works will be complied with 'Regulation on Excavation, Construction, Ruin Waste', which entered into force by being published in the Official Gazette dated 18 March 2004 and numbered 25406.

In all stages of the project, the provisions of Regulation on Control of Industrial Based Air Pollution, which was entered into force by being published in the Official Gazette dated 03.07.2009 and numbered 27277, and its relevant amendments of

OG-30.03.2010-27537

OG-10.10.2011-28080

OG-13.04.2012-28263

OG-16.06.2012-28325

OG-10.11.2012-28463

OG-20.12.2014-29211 shall be complied with.

During the construction of the infrastructure, dust emissionary mechanical processes such as crushing, grinding, transporting, storage shall not be performed. Materials and equipment required will be supplied from the market. Soil will be wetted to prevent dusting during excavation and loading. During the transportation of materials, the trucks shall be covered with a tarpaulin and measures shall be taken against dusting. This situation is limited to the construction period and will be eliminated after the completion of the construction works.

III.1.10. Size of agricultural fields to be disposed of in order to obtain the necessary land during the preparation and construction phase of the land, their utilization capabilities and agricultural product types, Evaluation of agricultural lands within the scope of information on the use of agricultural land for non-agricultural purposes, Distance of the project site to agricultural lands if all or part of the project area is outside agricultural lands, evaluation of their impacts, measures to be taken

The project is planned on a total area of 32.283,345 m² in the parcel number 141 Island 121, 133, 119, 97, 102 and parcel number 245 Island 147 in the province of Aydın, Germencik District, Mesudiye Neighborhood and Seyrekkovalık Locality. The ownership of the area belongs to the investor company.

According to the 1 / 25.000 scale-land asset map presented in Annex-3, there are Alluvial (A) soils as a large soil group within the power plant area.

Dust suppression will be carried out during construction activities so that the agricultural land near the facility area is not affected by the activity. In addition, regular maintenance of construction machinery will be carried out to control their emissions.

By disposing the solid and liquid wastes that will occur during the operation within the framework of the relevant legislation, underground and surface water resources and soil pollution will be prevented.

The surplus excavation materials and wastes like the panel strip, that won't use within the scope of project, during the preparation of the land and during the construction works, all construction activities for the power plant, which is one of the permanent fixed manufacture also in drilling locations, will not be poured into the river bed and the existing flood protection structures will not be damaged. Domestic wastewater will be disposed of in accordance with the provisions of the Water Pollution Control Regulation and Water Products Regulation. The provisions of the Fisheries Law No. 1380 shall be observed at all stages of the project.

Before starting work on the construction of the project; according to 5403 "Soil Protection and Land Use Law" and "Soil Protection and Land Use Law Implementing Regulations", which is numbered 26024 and enacted by publishing in Official Gazette on 15.12.2005, shall be applied for "Non-Agricultural Purposes Use Permit" to the Provincial Directorates of Ministry of Food, Agriculture and Livestock.

For land preparation and construction in order to provide the necessary land for the construction field, for the use of the agricultural land to be used under the project in nonagricultural purposes, according to 19.07.2005 dated and 25880 numbered, enacted by 5403 numbered Official Gazette "Soil Protection and Land Use Law" provisions, the necessary permits shall be obtained the Ministry of Food, Agriculture and Livestock's Provincial Directorate in Aydın and / or from the Ministry Food of Agriculture and Livestock Ministry of Food, Agriculture and Livestock.

No non-agricultural activities will be carried out in the project area during the process of obtaining legal permits.

During construction and operation phase; Under the 11th and 12th articles of the Fisheries Regulation and 20 article of the Water Products Law of the No. 1380, no harmful substances will be disposed into the receiving environment and no water pollution will be caused.

In the construction phase, the topsoil layer will be stripped first in the activity field. This layer shall be stored in the vegetable storage area for the purpose of surface coating in the subsequent landscaping works, separately from the excavation surplus material and shall be reused in the restoration works after the construction is completed.

In cases where the stored soil is not used immediately and it is necessary to keep it for a long time, over the vegetative soil stores will be protected against erosion, drying and surrounding by wild grass and will be covered with vegetation like weed and grass, meadow-pasture plant and so on, on the purpose of continuation of soil's revival.

III.1.11. Whether trees to be cut down in order to obtain the necessary land during the preparation and construction phase of the land, If to be cut, species and quantities of trees to be cut, stand type, closure, impacts on the forest ecosystem within the region; Distance of the project site to forest lands if all or part of the project area is outside forest lands, evaluation of their impacts, measures to be taken

There will not be any woodcutting related to forest areas due to the absence of any forest assets and trees in the project area and its vicinity.

There are no seed stands, seed gardens, gene protection forests, honey forests, urban forests, areas reserved for scientific studies and protection forests in the vicinity of the project area.

The project field is not located within the forest area. It is 1.5 km from the nearest forest area to the project field.

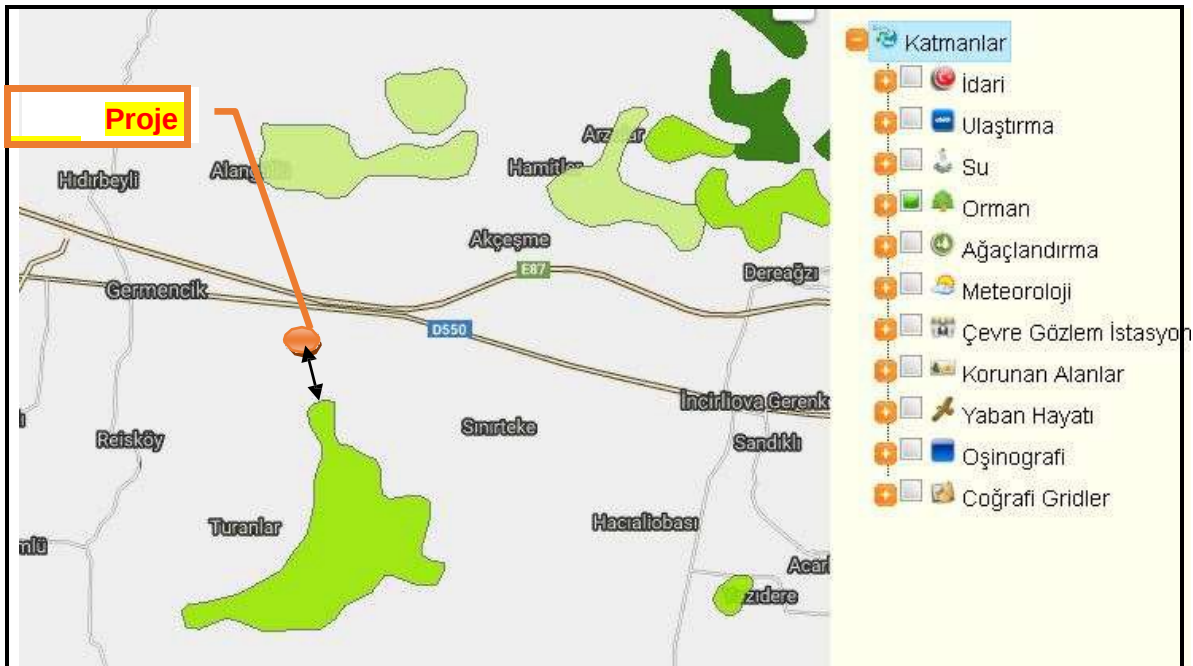


Figure 96. Project Area and Closest Forest Areas

Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr>, January, 2017.

In order to prevent possible negative effects on forest areas, personnel will be prohibited to fire in the field and to throw the flammable substances on the field. It will be acted in accordance with Fire and Emergency Plan against possible forest fires. The staff will be informed about the forest fire alarm line and the personnel to be employed in the facility will be informed about the fire.

III.1.12. Water supply system plan, where from to supply; Types and amounts of wastewater, disposal methods, discharge areas

Staff Water Requirement

During the construction phase of the facility, two types of water will be needed for the use of drinking and using water and dust suppression of the personnel.

During the construction phase, the need for drinking and using water for the personnel will be provided with the carboys or tankers that will be brought to the facility area.

Drinking and potable water during construction phase shall be provided in accordance with the provisions of the T.C. Ministry of Health's 'Regulation on Water for Human Consumption Purposes' which was published in the Official Gazette and enacted by being published, dated 17.02.2005 and numbered 25730, The Regulation on Amendment of 'Regulation on Water for Human Consumption Purposes', which was entered into force by being published in the Official Gazette dated 07.03.2013 and numbered 28580.

It is foreseen that 250 people will work during the construction phase of the activity. If the daily water consumption per person for these personnel is 181 lt²⁷;

$$\begin{aligned} \text{Amount of water use of personnel} &= (\text{amount of water use per person}) \times (\text{number of personnel}) \\ \text{Personnel water usage} &= 181 \text{ lt/day} \times 250 \text{ person} \\ &= 45.250 \text{ litres/day} \\ &= 45.25 \text{ m}^3/\text{day} \text{ will be.} \end{aligned}$$

The number of personnel specified in the construction phase of the project refers to the total number of personnel to be employed in all construction works. At the same time, less than 250 personnel would have worked in the field of activity. The article on the provision of water for use by Aydın Metropolitan Municipality is presented in Annex-22.

In the regulation on Water Pollution Control, which is published in the official gazette No. 25687 and dated 31.12.2004 (amended by O.G. No. 26786 dated 13.02.2008, O.G. No. 27537 dated 30.03.2010 and RG No. 27914 dated 24.02.2011), during the disposal of liquid wastes that will occur during the construction phase of the project will comply with all matters.

Domestic wastewater, which will emerge during the land preparation, construction and operation phases, will be collected in septic tank and will be disposed of by the sewage truck in certain periods in return for the fee and given to the treatment plant. The letter that the domestic wastewater will be disposed by the sewage truck by Aydın Metropolitan Municipality is presented in Annex-21.

²⁷ Source: TÜİK, Municipal Water Statistics-2014.

III.1.13.Types and quantities of solid wastes to be generated, Where to dispose of these wastes or for which purposes they are to be used, disposal methods

Domestic Solid Waste

250 people will work during the construction phase of the planned project. Therefore, domestic solid waste generation from the personnel to be employed will occur. During the construction phase of the project; The amount of solid waste generated by the acceptance of the amount of solid waste produced per person per day of 1,16 kg / day²⁸, which will be operated by 250 people, is given below.

Amount of domestic solid waste to be generated = 250 person x 1,16 kg/day-person
= 290 kg / day is calculated.

The total number of personnel specified in the construction phase of the project is 250, which is the total number of personnel employed in all construction works. At the same time, fewer than 250 staff members would have worked in the field of activity.

Domestic solid wastes generated from personnel during the operation phase of the activity; According to their qualifications within the project area (organic, glass, plastic, paper, metal, etc.), they shall be collected in separate containers and shall be kept in sealed containers such as appearance, dust, odor and similar factors so as not to pollute the environment. The solid wastes to be collected in the facilities shall be disposed to the solid waste collection system of the Municipality of Germencik, which is the nearest municipality, in certain periods.

The provisions of the Waste Management Regulation, which was published in Official Gazette, dated 02.04.2015, numbered 29314 and enacted by being published, shall be complied with during the collection, storage and transportation of domestic solid wastes.

Packaging Waste

The wastes that can be recovered and generated during the construction phase of the project, within the frame of the Regulation on Control of Packaging Wastes, which was published in the Official Gazette dated 24.08.2011 and numbered 28035, and all amendments made in this regulation; will be collected separately from the other solid wastes and will be delivered to the company at regular intervals within the scope of the contract to be made with the company that has collection license of packaging waste.

During the studies to be carried out, the " Regulation on Control of Soil Pollution and Point-borne Contaminated Areas" (amended: OG-14.6.2012-28323, OG-11.7.2013-28704), which was published in the Official Gazette dated 08.06.2010 and numbered 27605, will be complied with.

Waste Oil and Hazardous Waste Generation

No waste generation due to maintenance and repair activities will be observed in the facility and will be taken to the temporary waste storage area in the switchyard if it occurs, and then disposed within the framework of the relevant regulations.

²⁸ Source: TÜİK, biruni.tuik.gov.tr, 2014.

Within the scope of all works to be carried out in the project area, the provisions of the Regulation on Control of Waste Oils, which is entered into force by being published in the Official Gazette, dated 30.07.2008 and numbered 26952 (Amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013 -28 812) will be complied with.

In case of maintenance and repairs in the project site, it shall be carried out in a sealed area and the the " Regulation on Control of Soil Pollution and Point-borne Contaminated Areas", which was published in the Official Gazette dated 08.06.2010 and numbered 27605, will be complied with, during the works to be carried out. (Amended: OG-14.6.2012-28323, OG-11.07.2013-28704).

However, the provisions of the "Waste Management Regulation", which came into force after being published in the official gazette dated 02.04.2015 and numbered 29314, will be complied with for hazardous wastes that are likely to occur at all stages of the project.

Waste Batteries and Accumulators

Since the maintenance and repair of the vehicles and equipment to be used in the scope of the construction of the project will be carried out at authorized service stations outside the scope of the activity, the battery changes will also be made outside the facility. Waste accumulators formed will be given to the service station where the new accumulator is purchased.

However, in case of an emergency situation, if the battery changes are carried out at the project site, the waste batteries that are likely to be occur will be temporarily stored in a closed and sealed environment in the project area and will be disposed of by giving to recycling to a recovering / recycling company licensed by the Ministry of Environment and Urbanization, in accordance with the provisions of the Regulation on Control of Waste Batteries and Accumulators, which entered into force by being published in the Official Gazette dated 31.08.2004 and numbered 25569 (Amended: OG-30.03.2010 / 27537, OG-5.11.2013-28812, OG-23.12.2014-29214).

In the construction phase of the planned activity shall be complied with the provisions of the "Regulation on The Regular Storage of Waste", which is published in the Official Gazette, dated 26.03.2010 and numbered 27533 and entered into force on 01.04.2010 (amended: O.G.: 11.03.2015 – 29292) and the "Regulation on The Control of Waste Batteries And Accumulators" (and all amendments in the regulation), which is published in the Official Gazette, dated 31.08.2010, numbered 25569 and enacted by being published.

End of Life Tires

Vehicle tires which are likely to result from the vehicles to be operated during the operation phase of the activity, in accordance with the Regulation on Control of End of Life Tires, which is dated 25.11.2006 and numbered 26357 (Amended: RG-30.03.2010-27537, RG-10.11.2013-28817, RG-11.3.2015-In accordance with the provisions of 29292) will be stored temporarily in a closed and sealed environment in the project area and will be provided to dispose by giving to the recovering / recycling company licensed by the Ministry of Environment and Urbanization.

Medical Waste

During the construction phase, the personnel who will work will have medical equipment capable of performing the first intervention when they are faced with an accident; as no medical interventions such as injections, sutures, cutting, puncturing medical wastes will occur. In the event of more severe injuries and accidents, it will be shipped immediately. In this context to the health institutions located in the nearest residential units, it is estimated that there will be very little amount of waste in the facility, although the amount of waste will not be determined.

All medical wastes likely to occur in the facility; resistant to tear, puncture, explosion and transportation, medium density polyethylene raw material, double bottom and non-blind, double layer thickness 100 micron, with a minimum lifting capacity of 10 kilograms, with the emblem of “International Biohazard”, which appears clearly on both sides and is black colour and red plastic bags with the phrase of ‘CAUTION! MEDICAL WASTE!’ will be used. The bags will be filled at a rate of $\frac{3}{4}$ at most and their mouths will be tightly bonded, and if necessary, each bag will be put into another bag with the same properties and a definite seal will be provided. The contents of the medical waste bags will not be compressed in any way, the medical wastes will not be removed from the bag, unloaded and transferred to another container.

Cutting and penetrating wastes, apart from other medical wastes, shall be collected in plastic or carrying boxes or containers made of laminated cardboard with the same characteristics, which are resistant to tear, puncture, break and explosion, waterproof and leak-proof, cannot be opened and devled, ,with the emblem ‘International Biohazard’ in black letters and carries the phrase of ‘CAUTION! CUTTER AND PENETRATIVE MEDICAL WASTE!’ in black letters. These storage containers will be filled with a maximum of $\frac{3}{4}$, their mouths will be closed and placed in medical waste bags. After the breaker-piercing waste containers are filled, they will absolutely not be compressed, opened or emptied. These storage containers will be filled up to $\frac{3}{4}$ of the maximum, their mouths will be closed and placed in medical waste bags. After the cutting and penetrating waste containers are filled, they will absolutely not be compressed, opened or emptied.

All phases of the project will be in accordance with the provisions of the “regulation on the control of Medical Waste Control”, which was published in the Official Gazette, dated 25.01.2013, numbered 29959 and enacted by being published.

III.1.14. Vibration, sources and level of noise, cumulative values, measures to be taken

In the field preparation and construction phase of the planned project, there will be environmental noise induced by construction machinery and equipment which will work in the field of activity.

The characteristics of the machinery and equipment that may cause noise during the construction phase within the scope of the project are given in Table.67. The distribution of the average sound pressure levels to be obtained from the mentioned vehicles according to the distance is shown in Table.68, while the distribution graph is shown in Figure.103.

Table 67. Quantity and Characteristics of Machinery And Equipment To Be Used In Construction Phase

MACHINE-EQUIPMENT	PIECE	VOLUME POWER LEVEL (dBA)
Excavator	1	105
Loder	1	113
Trucks	4	94
Cylinder	1	94
Concrete Transmixers	1	108
Concrete Pumps	1	94
Diesel Engine Crawler Crane	1	105

Excavator (Excavator: Trench excavator)

The total noise level of the Excavator (Excavator: Trench excavator) vehicle is 105 dBA and the distribution according to the frequencies is given as follows.

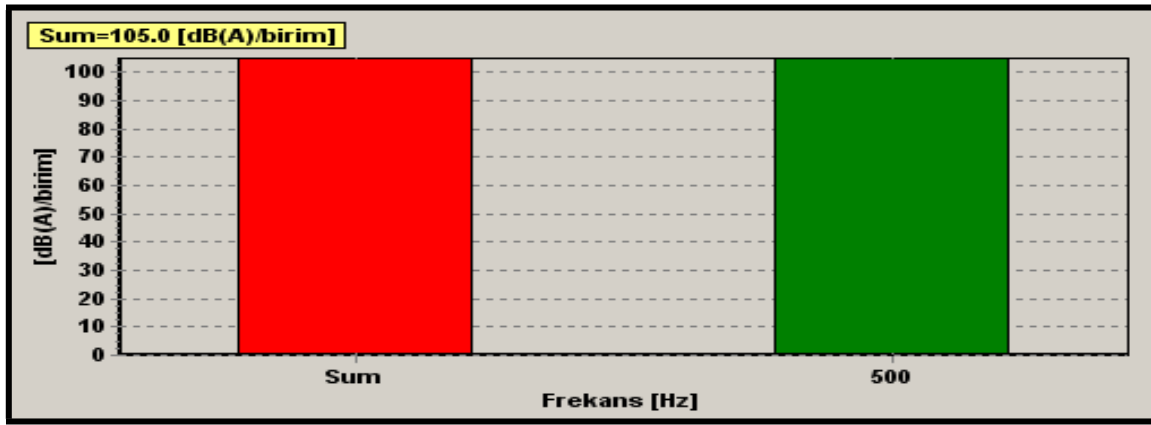


Figure 97. Frequency Analysis of Excavator's Noise Level

Loader: (Loader: wheeled loader <110 kW)

The total noise level to be generated by the (Loader: wheeled loader <110 kW) is 113 dBA and the distribution according to the frequencies is given as follows.

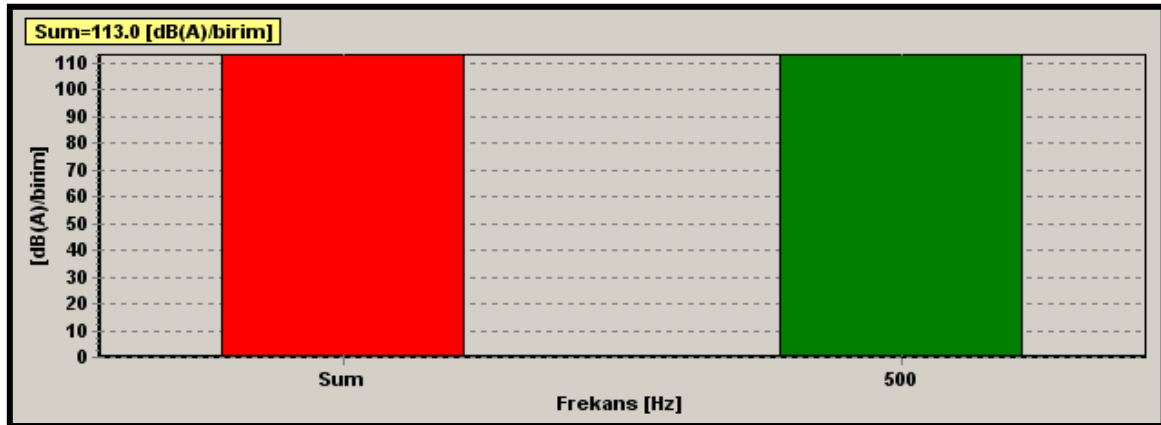


Figure 98. Frequency Analysis of the Loader's Noise Level

Dump Truck

The total noise level generated by the truck vehicle (Truck: neutral) is 94 dBA and the distribution of this by frequency is given as follows.

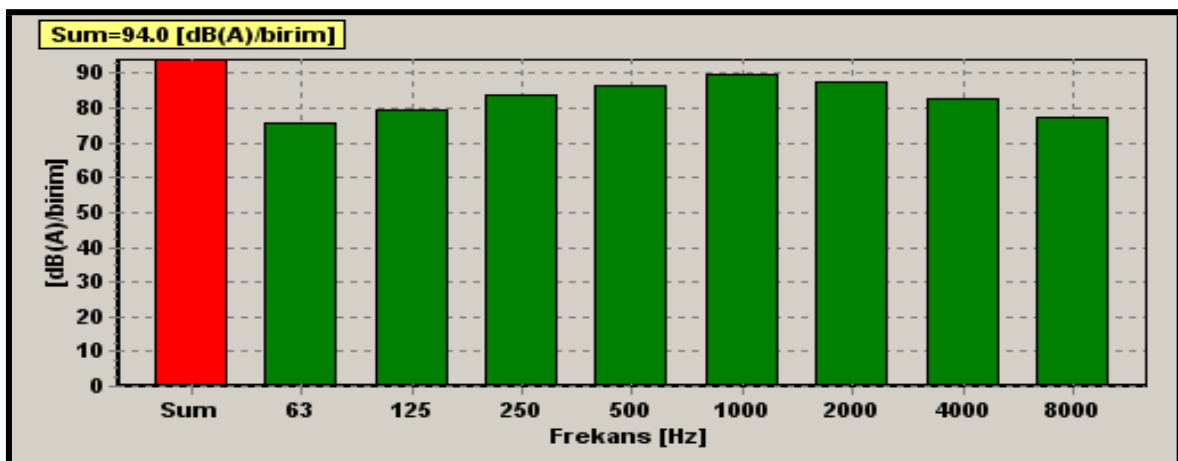


Figure 99. Frequency Analysis of the Truck's Noise Level

Concrete Mixer (Concrete mixer: 150 - 500 l, mec.filling)

The total noise level of the concrete mixer (Concrete mixer: 150 - 500 l, mec.filling) will be 108.0 dBA and the distribution according to the frequencies is given as follows.

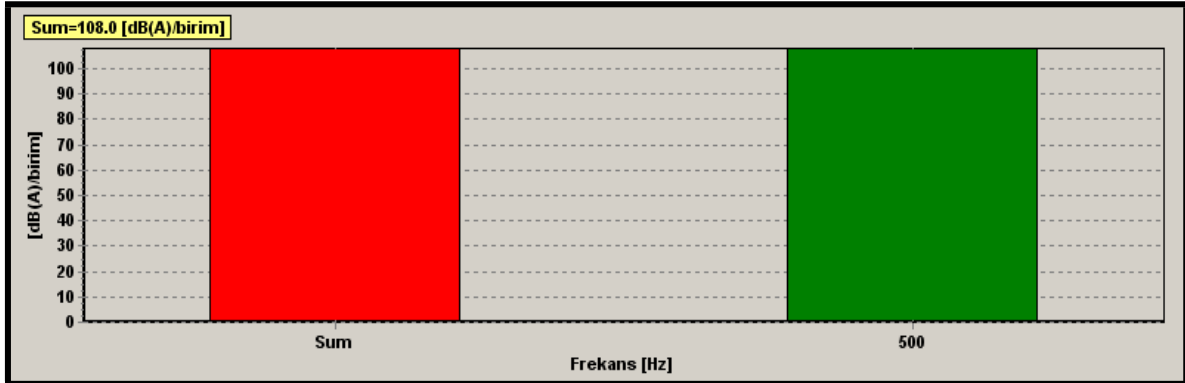


Figure 100. Frequency Analysis of the Concrete Mixer's Noise Level

Diesel Engine Crawler Crane (Construction crane:> 80 kW)

The total noise level of the diesel engine crawler crane vehicle is 105.0 dBA, the distribution according to the frequencies is given as follows.

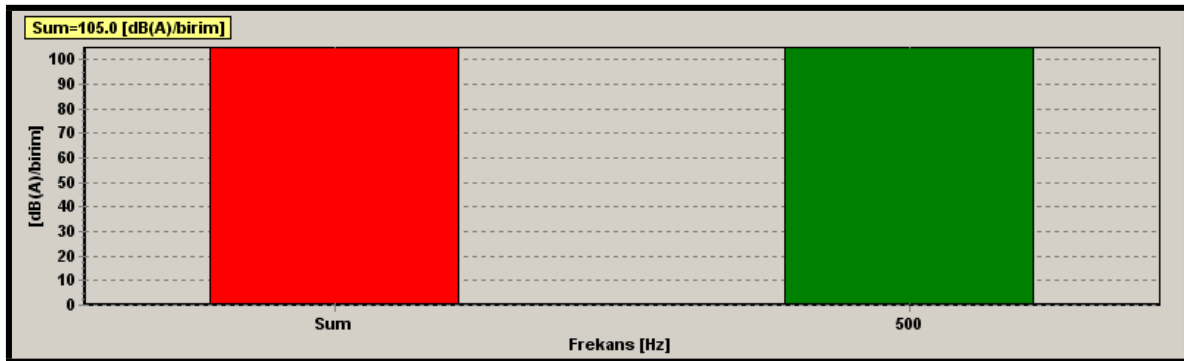


Figure 101. Frequency Analysis of the Crawler Crane's Noise Level

Noise will be generated from work machines that will work during the land preparation and construction phase of the project. In the calculation of the sound pressure level which will occur when considering the most adverse conditions;

$L_{pt} = 10 \log(10 \sum L_{pi} / 10)$ formula is used.
1=1

In the formula;

L_{pt} = Total sound pressure level,
 L_{pi} = Sound pressure level from each work machine is located.

The following formula is used to calculate the sound pressure level (L_{pi}) that will be generated by each machine at a distance from each source to be used.

$$L_{pi} = L_{wi} + 10 \log(Q / A)$$

$$A = 4 \pi r^2$$

Q = Coefficient of orientation (Semi-global distribution of ground-level sound source, $Q = 2$)

r = Distance from source (m)

L_{wi} = Sound power level of each work machine (dB)

The “decrease in sound due to the atmosphere”, which is mentioned as a_{atm} , varies depending on the frequency of the source and the distance from the source. The average frequency range for construction machinery and road vehicles was accepted as 3.000-3.500 Hertz. The following formula is used in the calculation of the result of atmospheric retouching at the average sound pressure level.

$$A_{atm} = 7.4 \times 10^{-8} \times F^2 \times r / \text{Berry}$$

In the formula;

A_{atm} = atmospheric retouching and sound pressure level drop (dBA)

f = frequency of transmitted sound (3500))

R = distance from the source (m)

ϕ = Relative Humidity Of Air (68.7%) (29))

The following formula is used in the calculation of the volume (noise) level.

$$L = LPT - a_{atm} + DF$$

In the formula;

L = Volume (noise) level (DBA),

DF = Correction Factor

The sound level is the weighted amount of sound pressure level according to a specific curve. It is used to express the volume of complex sounds with a single value. The sound level is a predetermined amount of sound pressure level relative to a certain curve. It is used to express the volume of complex sounds with a single value. Weights that are proportional to the sensitivity of the ear are used and these weights are named A, B and C. The correction factor-frequency curve used for the calculation of weighted noise (noise) levels is given as follows.

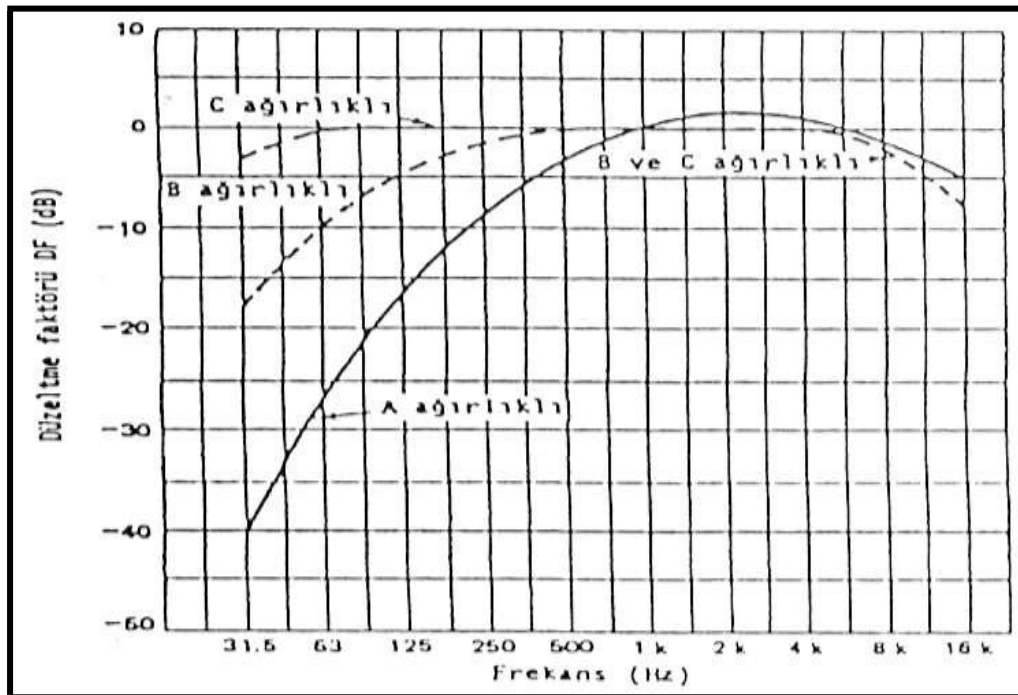
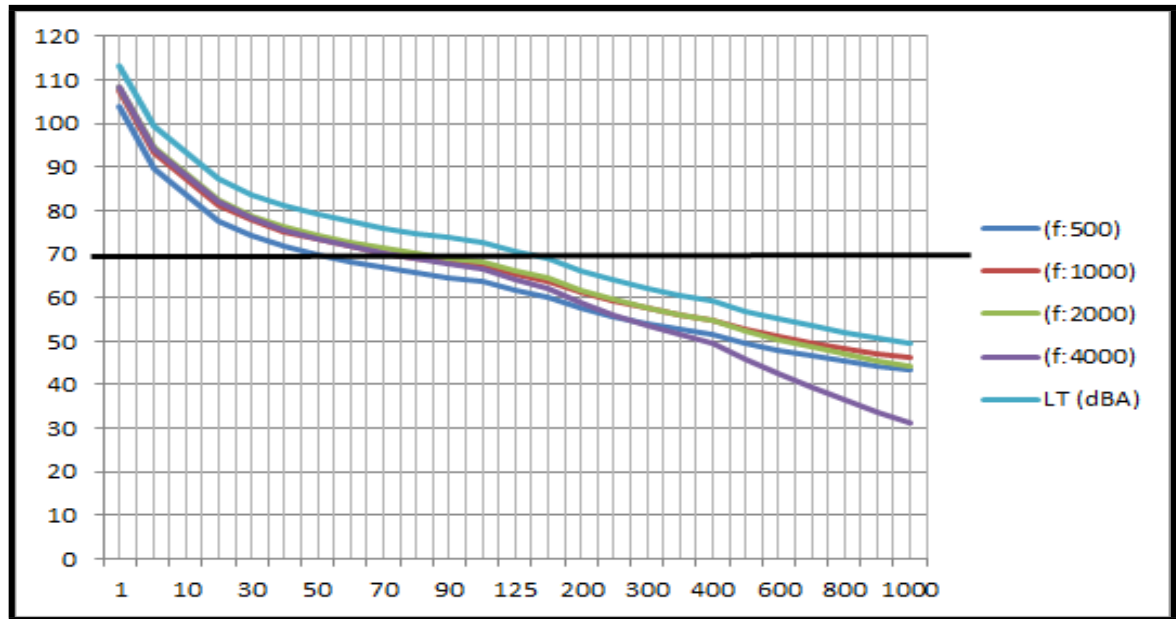


Figure 102. Conversion Curves for A, B and C Weighted Sound (Noise) Levels

Source: Özgüven, N. (Prof. Dr.), Industrial Noise Control

Table 68. Distribution Of Average Sound Pressure Levels From All Sources During Construction Stage By Distances

r (m)	PT (dBA)	Aatm (dBA) (f:500)	DF (f=500)	L (dBA) (f:500)	Aatm (dBA) (f:1000)	DF (dBA) (f=1000)	L (dBA) (f:1000)	Aatm (dBA) (f:2000)	DF (dBA) (f=2000)	L (dBA) (f:2000)	Aatm (dBA) (f:4000)	DF (dBA) (f=4000)	L (dBA) (f:4000)	LT (dBA)
1	107,35	0,00	-3,6	103,75	0,00	0	107,35	0,00	1,2	108,54	0,02	1	108,33	113,38
5	93,37	0,00	-3,6	89,77	0,01	0	93,36	0,02	1,2	94,55	0,09	1	94,28	99,37
10	87,35	0,00	-3,6	83,74	0,01	0	87,34	0,04	1,2	88,50	0,17	1	88,17	93,31
20	81,33	0,01	-3,6	77,72	0,02	0	81,31	0,09	1,2	82,44	0,34	1	81,98	87,22
30	77,80	0,01	-3,6	74,20	0,03	0	77,77	0,13	1,2	78,88	0,52	1	78,29	83,63
40	75,31	0,01	-3,6	71,70	0,04	0	75,26	0,17	1,2	76,33	0,69	1	75,62	81,07
50	73,37	0,01	-3,6	69,75	0,05	0	73,31	0,22	1,2	74,35	0,86	1	73,51	79,06
60	71,78	0,02	-3,6	68,17	0,06	0	71,72	0,26	1,2	72,73	1,03	1	71,75	77,41
70	70,45	0,02	-3,6	66,83	0,08	0	70,37	0,30	1,2	71,34	1,21	1	70,24	76,01
80	69,29	0,02	-3,6	65,66	0,09	0	69,20	0,34	1,2	70,14	1,38	1	68,91	74,79
90	68,26	0,02	-3,6	64,64	0,10	0	68,17	0,39	1,2	69,07	1,55	1	67,71	73,70
100	67,35	0,03	-3,6	63,72	0,11	0	67,24	0,43	1,2	68,12	1,72	1	66,62	72,72
125	65,41	0,03	-3,6	61,78	0,13	0	65,27	0,54	1,2	66,07	2,15	1	64,25	70,64
150	63,83	0,04	-3,6	60,18	0,16	0	63,66	0,65	1,2	64,38	2,59	1	62,24	68,91
200	61,33	0,05	-3,6	57,67	0,22	0	61,11	0,86	1,2	61,66	3,45	1	58,88	66,15
250	59,39	0,07	-3,6	55,72	0,27	0	59,12	1,08	1,2	59,51	4,31	1	56,08	63,96
300	57,80	0,08	-3,6	54,12	0,32	0	57,48	1,29	1,2	57,71	5,17	1	53,63	62,15
350	56,47	0,09	-3,6	52,77	0,38	0	56,09	1,51	1,2	56,16	6,03	1	51,43	60,60
400	55,31	0,11	-3,6	51,60	0,43	0	54,88	1,72	1,2	54,78	6,89	1	49,41	59,24
500	53,37	0,13	-3,6	49,63	0,54	0	52,83	2,15	1,2	52,41	8,62	1	45,75	56,95
600	51,78	0,16	-3,6	48,02	0,65	0	51,14	2,59	1,2	50,40	10,34	1	42,44	55,06
700	50,45	0,19	-3,6	46,66	0,75	0	49,69	3,02	1,2	48,63	12,06	1	39,38	53,44
800	49,29	0,22	-3,6	45,47	0,86	0	48,42	3,45	1,2	47,04	13,79	1	36,50	52,04
900	48,26	0,24	-3,6	44,42	0,97	0	47,29	3,88	1,2	45,58	15,51	1	33,75	50,79
1000	47,35	0,27	-3,6	43,48	1,08	0	46,27	4,31	1,2	44,24	17,23	1	31,11	49,66

**Figure 103. Distribution Of Average Sound Pressure Levels From All Sources During Construction Stage By Distances Graph**

Conclusion and Evaluation

The environmental noise level for the construction site and the maximum acceptable noise levels for the prevention of noise, levels Table.Given in ' 69.The highest acceptable noise levels for environmental noise level and noise for the construction site, as outlined in the Regulation on the Assessment and Management of Environmental Noise,which is published in the Official Gazette ,dated 04.06.2010,numbered 27601 and enacted by being published, are given in Table.69.

Table 69.The Value of the Environmental Noise Limit for Construction Site

Type of activity (construction, demolition and repair)	L _{day} (dBA)
Building	70
Road	75
Other resources	70

The noise levels of the construction phase given in the table are compared with the noise limit values specified in Annex-VII Table-5.it is observed that 70 DBA limit values were obtained after 125 m distance during the construction phase.

The construction activities to be carried out within the scope of the project will not have any negative impact on the residential areas.

During the construction phase of the project, all the machinery and equipment that will cause noise will be regularly maintained and renewed after their economic life is complete. In addition, the personal protective equipment (headphones, etc.) will be provided to use for employees working in the facility.

III.1.15. Where and how to meet the housing and other technical/social infrastructure needs of the staff and the population affiliated to this staff

Most of the personnel planned to work during the construction phase of the project are planned to be supplied from the region. However, it is planned to establish a prefabricated administrative office and construction site to meet all kinds of needs within the main construction site to be established within the plant area for qualified workers coming from outside. In the drilling works, workers shall meet their needs from the portable containers (administrative-social building) to be formed at well locations.

Structures such as cafeteria, toilet, bathroom will be established to meet the needs of the personnel to work on the site to be established. It is thought that some of the staff to work will reside in close settlements.

III.1.16.Works risky and dangerous for human health and environment, measures to be taken

During the construction phase of the planned project, impacts on human health are work accidents and potential health problems that may occur in the construction site. In order to minimize these effects, all necessary measures shall be taken within the framework of the "Regulation On Occupational Health And Safety".

It is among the measures that the users of the construction machinery to be working during the construction phase are trained and have a certificate of competence. In addition, the working hours of the staff will be limited to eight hours.

Measures to be taken in order to reduce the impacts, which may be risky for human and environment, include accident, fire and safety. Security measures will be taken in the facility area and the guard will be kept continuously.

There will be sufficient tools and equipment in the facility to be used in any fire and similar natural disasters in and around the site. Thus, in case of any fire, the fire will be intervened as soon as possible. In addition, all kinds of precautions will be taken against the possible accidents in the related regulations. First aid in respect of accidents that may occur in the facility will be made primarily with the health supplies to be kept in the facility. In case of more severe injuries and accidents, these will be sent urgently to the health facilities in the nearest settlement .

III.1. 17. Determination of Effects On Flora/Fauna And Measures To Be Taken

The fact that the project site is in agricultural land, that the natural plant species are wide spread, that these species are abundant in the areas around the plant area, that there are no endangered and endemic plants, shows that their effects on flora may be very low in terms of plant species. In order to reduce this effect further, during the construction activities, it will be ensured that the stripped topsoil is stored and used in landscape applications to be made during the operation phase. The necessary measures to be taken to reduce the effects in the construction phase are as follows:

- Before the start of construction activities, the existing topsoil in the land will be stripped and stored and spreaded to the landscaping areas after construction; thus, the germination or planting of seeds belonging to natural plant species will be provided.
- Construction activities will be carried out gradually to allow animals to leave the area.
- Dusting will be prevented by continuous irrigation in the area during construction activities.
- Regular maintenance of the equipment will be carried out during the construction phase.
- During construction activities, the placing of machinery/equipment, outfit and workers in non-use areas will be prevented.
- Wastes that will occur during construction activities will be disposed of within the framework of the legislation.
- For the personnel to work in construction to behave consciously (to not fire in the area, to not hunt, etc.) pre-activity trainings will be given.

The provisions of the Bern Convention shall be complied with. The provisions of the CITES Convention (Convention on the International Trade of Endangered Species of Wild Plants and Animals) shall be complied with.

III. 1.18. Determination of potential impacts on underground and aboveground cultural and natural assets (traditional urban texture, archaeological remains, Natural values needed to be protected), and measures to be taken

If any cultural assets are encountered during the construction works in the project site, the operation will be stopped and according to Article 4 of Law No 2863, the nearest civilian administration or Museum Directorate will be notified.

III.1.19. Amount of area and the methods of site arrangements to create landscape elements or for other purposes within the project site (forestation and/or green field arrangements, etc.)

In the scope of the project, the minimum damage that may occur during the construction works will be targeted, the soil structure within the working area and the surrounding areas, vegetation-intensive areas, bushes and forests will be protected as much as possible.

After the completion of the construction phase of the planned project, the vegetable soil stored separately from the excavation material will be used in planting and landscaping works in accordance with the climate and soil characteristics of the region to be used as a priority.

In order to correct the landscape and geomorphological changes to be created by the facilities to be constructed within the scope of the project, planting and landscaping arrangements will be made with the species suitable for the region.

The use of the species found in the JES site prior to construction activities in the selection of plant material is important for the preservation of habitat relations. However, due to the problem of slow growth of these species in terms of their physiological characteristics and due to problems of their supplement, different species can be used in species selection. Many factors need to be considered in the selection of plant material to be used in the landscape repair process. These factors can be grouped under the following headings. (Southern 1989)

- **Ecological criteria:** Plants should first comply with the area in which the area will be introduced and then the micro-ecological characteristics of the area. The annual temperature distributions and maximum and minimum temperatures, precipitation amount, soil and air humidity, salinity, liminess rate, wind, soil pH, air, soil and water pollution play an important role in the selection of restrictive features.

- **Functional criteria:** The chance of success should be increased by selecting plants that complement each other in terms of various characteristics. Plants that overlies the soil surface well, have dense branches and leaf tissue, have a deep and strong root structure, have an over-ground accent that prevents water and soil movements on the surface, and can spread to the area with rhizome and stolons should be present. The growth rate should be slow and the branches should not be fragile.

- **Cultural criteria:** Selected plant; depending on the size of the area to be worked can be produced in large quantities and easily, should not require special devices, structures and chemical materials. Where they are planted both at the production site and where they are planted, their maintenance needs should be minimal.

- **Economic criteria:** In the most economical way, plants should be taken as the basic principle except for some special problems. Plants which can be used instead of each other can be obtained in the easiest and cheapest way and planting will be carried out in the most economical way, transportation costs should be the lowest and plants with the highest chance of rooting it should be preferred.

The target is to rebuild the ecological systems by using the “Natural Landscape Arrangement” methods. After the construction, the first work to be carried out within the scope of reinstatement of the fields of activity will be brought to the former level of the land. Within the scope of Efe-7 JES Project, it is tried to comply with its surrounding natural area as much as possible during the old leveling works in areas where land topography is expected to be disrupted.

After the land has been brought to the old leveling, necessary drainage systems will be formed at the necessary points both under the ground and on the surface and the work on the topsoil stripping will be started.

Stripping of the upper soil, taking the erosion and sedimentation measures during the construction period, land leveling, top soil laying, planting are steps to be made.

Plants to be used in landscape repair works are expected to have a wide ecological propagation area. Some important species that can be used in repair from these plants are given below;

a- Trees: *Acer negundo* (Maple), *Acer campestre* (Maple), *Ailanthus altissima* (Poinciana), *Betula pendula* (Birch), *Pinus nigra* (Larch sylvestris), *Populus nigra* (Black Poplar), *Populus tremula* (Trembling Poplar), *Prunus mahaleb* (Mahaleb), *Pyrus amygdalus* (Wild Pear), *Quercus infectoria* (Thuja Oak), *Robinia pseudoacacia* (Black Locust), *Salix alba* (White Willow), *Salix nigra* (Black Willow).

b- Arbuscules and Shrubs: *Cistus* (*Cistus*) species, *Colutea arborescens* (*Colutea*), *Crataegus* (Hawthorn) species, *Elaeagnus angustifolia* (Silverberry), *Gleditschia triacanthos* (*Gleditschia*), *Ligustrum vulgare* (Privet), *Lonicera xylosteum* (Honeysuckle), *Pyracantha coccinea* (Firethorn), *Quercus* (Oak) species, *Rhus typhina* (*Rhus*), *Rosa canina* (Rosehip), *Salix purpurea* (Purpleosier Willow), *Tamarix* (*Tamarix*) species,

c- Herbaceous Plants: *Trifolium pratense* (White Clover), *Trifolium repens* (Lucerne), *Lotus corniculatus* (Birdfoot Deervetch), *Tussilago farfara* (Coltsfoot), *Melilotus albus* (Melissa), *Melilotus officinalis* (Melissa), *Medicago sativa* (Alfalfa), *Astragalus* (Milk Vetch) species, *Festuca rubra* (Bluegrass), *Lolium perenne* (Perennial grass), *Silene* species (Catchfly), *Dactylis glomerata* (Porentilla), *Agrostis alba* (Bent-grass), *Cynodon dactylon* (Quackgrass), *Poa pratensis* (Wild wheat), *Poa trivialis* (Wild wheat).

III.1.20. Impacts of the activity on biodiversity and ecosystem, and measures to be taken

During the construction phase of the planned project to be carried out the construction phase of excavation, digging, noise and vibration of construction machinery vehicles and equipment, dust and emissions, solid wastes, liquid wastes are the potential negativity on the area of activity and the immediate surroundings of the planned facility.

During the construction period of the project, the moving fauna species, which lie on area, will leave the field with dust and noise during construction period.

Flora species found in the project area are not narrow and limited spread in our country or endangered. Therefore, with the realization of this project, there will be no threat to the extinction of the generations of the wide spread and abundant species in the area.

During the excavation phase, the topsoil will be removed by stripping process as a result of the work of the construction machinery in the field. However, after completion of the construction works, the topsoil layer (organic matter and mineral rich soil), which stored in the area where the activity was not carried out, will be re-propagated to the appropriate habitats in the vicinity of the operation area after the construction works are completed and the scrub and herbaceous species will be re-propagated in the nearby habitats with land reclamation. As a result of these studies, there will be no environmental impact for these flora species during construction and operation phase.

In the installation phase of the project, air pollution will be prevented by controlling the amount of mass emissions resulting from the use of work machines and by checking the limit values determined for these emissions in the Regulation on Control of Air Quality. Emissions are not harmful to plants and animals when they are in normal concentrations. Therefore, there is a temporary effect on the environment of flora and fauna during the installation phase of the facility.

Noise and dust formation will be occurred during operation and excavation. The noise levels generated by the equipment used in the field are related to the motor forces of the equipment and the noise levels are calculated. During the operation phase, the noise level will be calculated and the existing noise level will not be exceeded. In order to prevent the formation of dust, irrigation will be done during the construction and operation phase and the dust will be prevented and the habitats, where the plants and fauna can use, will not be affected by the dust.

If it is deemed necessary during the periods of the construction season that coincide with the incubation/reproduction period, care shall be taken to minimize the noise.

During the operation and excavation phase, in the face of adverse events that may occur on flora and fauna, it will be not interfered to the fauna species' drinking water, access to feed source, shelter and breeding areas and at the same time will not obstruct the vital activities of flora and fauna with the measures to be taken in accordance with the hunting bans and the measures to be taken.

Because of the activity, species and other wildlife species specified in the fauna lists and protected by international conventions shall not be subject to any commercial concern with regard to the activity; there will be no impacts such as the hunting of these species, deliberate killing, detention, damaging to the eggs.

In addition to the measures that can be taken during the construction phase, if any type of fauna which is sensitive, which is likely to be damaged and which has been protected in the project area is determined, the relevant regulations will be followed. These species shall be protected in accordance with the measures of the Land Hunting Law and Regulations No. 4915 and international conventions (Bern and CES convention).

In the project area and near the area, there is no recreation area with high landscape value. The area where the project will be carried out will differ from the present situation both visually and structurally during the construction period of the project and during the operation phase.

For this reason, after the construction period and after the operation is closed for the project, necessary works will be carried out in order to restore the area and planting activities in accordance with the vegetation cover of the region will be done. A topography will be obtained close to the natural appearance of the project during the operation phase with the arrangements and improvements to be made in the deteriorated topography during the construction phase. After the power plant area is completed, greenening and planting studies will be done in unused areas.

III.1.21. Other Provisions

There is no other issue to be specified under this heading.

III.2. Impacts of the project on the physical and biological environment during the operation phase and measures to be taken

III.2.1. Characteristics of All Units Within The Scope of The Project, Which Activities To Be Performed in Which Units, Their Capacities, Amount of Energy To Be Produced, How To Transmit of Energy To Be Produced, Working Time of The Power Plant Are

Depending on the fluid temperature of the geothermal reservoir, the type of process used in the plant varies. At temperatures of 180 °C and above, in single and double-phase fluidic "flash" type plants, the steam separated from the liquid is supplied directly to the steam turbine and electricity is produced.

Geothermal fluid temperature 100 - 180 °C in the range of low-and moderate enthalpy geothermal resources in quantities appropriate for the process “Two-Fluid Circuit (Binary) Operator” type. The majority of the power plant area established in our country is this type. In the Binary Energy Power Plant Area, the geothermal fluid heat is loaded into a second low fluid, which has the low liquefying heat such as pentane, izo-pentane, izo-butane, in geothermal heat exchangers. The energy of the second fluid expanding in the turbine under pressure (motivated fluid) is transformed into rotational momentum by pushing the turbine blades. The turbine output is liquefied in the condenser to enter the cycle and the Rankine cycle is closed circuit is repeated and energy production is continued.

Binary Power Plant consists of two parts:

- 1 - Electrical production department: The department, which produce electricity from liquid heat with organic Rankine cycle
- 2- Auxiliary Services Section: BOP in Blance of Plant section consisting of production wells, transmission lines, lifting pumps and re-injection system where the fluid is provided.

The main event in the Rankine cycle is to condense the pentane sent to the condenser to recycle from the turbine outlet at a temperature as low as possible. In other words, condenser design is vital. Given the “summer collapse” which is caused by the increase in ambient temperature during the summer period and which exceeds 30%, it can be condenser type (air, water, hybrid). Condenser placement should be configured properly; the power plant area should be selected accordingly. In the air-cooled condensers, side-by-side placement should be preferred instead of the back-to-back condenser placement that is applied for cost optimization of pentane diffuser.

In the scope of the project, double-fluid-binary system was chosen as the process. The fluid used in the heat cycle in the system is n-Pentane, a hydrocarbon type. Pentane absorbs the heat of the geothermal fluid. Thus, it causes the evaporation of pentane. The evaporated pentane goes to the turbine. Rotational shaft power is generated by conversion of kinetic energy gained as a result of the expansion of the pentane. The process of expansion of the pentane is carried out by the geothermal fluid, its energy has taken, in the pipe-bundle heat exchangers.

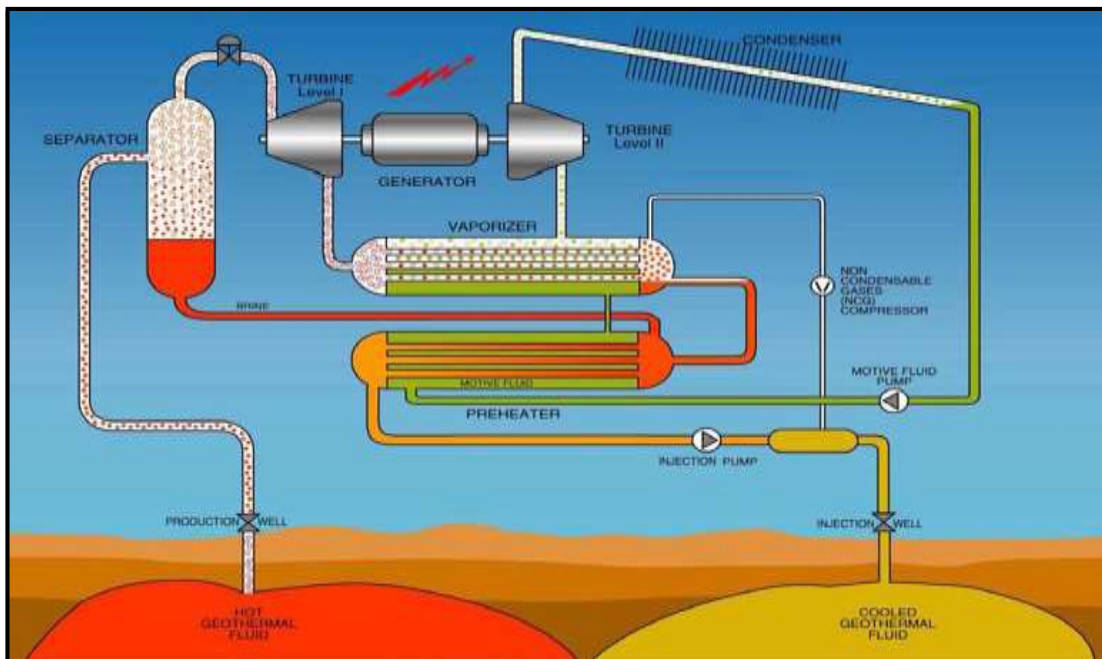


Figure 104. The General Working Principle of Power Plant Area

Geothermal superheated water, which comes into the evaporator heat exchanger sections in the process, transfers some energy and vaporizes the pentane. The evaporator exchanger enters into the hot water sections. The evaporator exchanger vaporizes the pentane together with the steam entering the vapor chamber. The geothermal water separated by transferring some energy from the evaporator exchanger is separated into the preheater tubes. The geothermal water that separates from the preheaters is combined and goes to the reinjection system from the power plant. The condensing steam is pumped out of the head of the evaporator heat exchanger and connected to the rejection line to be sent to the reinjection well.

The feed pumps pump the pentane from the condenser into the wall of the preheater. The pentane is heated in the preheaters and then flows into the evaporator wall. The pentane is heated to the boiling point in the evaporator and vaporized. The pentane moves towards the steam inlet, then enters and expands. In this pressure and temperature transition, rotational shaft power is produced. The low pressure pentane vapor, which is converted to energy in the turbines, goes to the aircooled condenser and liquefies. The liquefied pentane is again pumped into the preheaters.

Within the scope of Efe-7 Geothermal Power Plant, the electrical energy to be generated by the binary system will be transferred to 154 kV Germencik TM from the switchyard.

The total installed capacity of the power plant is 25 MWe. Within the scope of the project, annual energy generation is aimed to be approximately 200.000.000 k

Units and explanations of the facility, which is the project's subject, are given below.

Turbines, Generator

High-pressure secondary work fluid in the gas phase from turbines; enters to the turbines, provides to the turbine blades rotation and the kinetic energy generated in this way will be converted into electrical energy in the generator. Each turbine inlet will be equipped with check valves and system control will be provided. The cooling water system that provides cooling of the bearings and oil in the system will provide cooling of the turbine and generator's bearing components and oils.

Production and Injection System

In this system, the geothermal fluid will be collected from the production wells and transported to the separation station. The gas and liquid geothermal fluid to be separated from each other in this station will be sent to the evaporator.

In the evaporator, the secondary work flow will be overheated. An evaporation of the secondary work fluid in the evaporator will be ensured. The liquid geothermal fluid coming out of the evaporator will be sent to the preheaters and the transition of the secondary work fluid to the gas phase will be ensured. The liquid geothermal fluid coming out of the preheater will be transferred to the injection wells by means of the reinjection pumps and will be re-injected to the reservoir.

Non-condensing Gas Outlet System

The non-condensable gases from the evaporator are removed from the system by means of a silencer on the air cooled condenser.

Air Cooled Condenser

This system will be used for cooling and converting the secondary work fluid from the turbine to the liquid phase.

Circulation Pump and Recuperator

The secondary work fluid in the liquid phase from the air-cooled condenser will be pumped to the recuperator by means of the circulation pumps and will continue to flow through the preheater by loading the heat energy of the secondary work fluid in the gas phase directed to the air-cooled condenser in the recuperator.

Auxiliary Systems

In addition to the main systems mentioned above, auxiliary systems have been designed to provide the necessary system for the supply of the domestic water required for the power plant site and to provide the necessary system for the fire protection of the power plant equipment. It consists of water supply and fire response systems and fire water storage tank.

Power Plant Instrument Control System

It is a system composed of central control and protection system, monitoring instruments, check valves and panels, which are formed for the protection, automation and control from the control room of the power plant system.

Air System

It is a system consisting of compressors, dryers and tanks, which are installed to supply the compressed air required by the control valves.

III.2.2. Amount of geothermal sources required for the project Amount of auxiliary substances, Where and how to provide, Transportation, storage, their impacts during transportation and storage, measures to be taken

The maximum 1,500 tons / hour geothermal fluid to be produced from 10 production wells by Gürmat Electricity Production Inc. will be used in the Efe-7 Geothermal Power Plant.

The geothermal source used within the scope of the project will be re-injected with 5 reinjection wells.

Pentane will be used as the work fluid in the process. The pentane which will be used within the scope of the project will be obtained from abroad and transmitted to the project area.

Pentane, which will be used as work fluid, is stored in special containers and brought to the facility with special security measures. The pentane brought to the power plant area will not touch the wells in any way and the closed system will be transferred to the power plant with the pipes.

Pentane will not be kept in the construction site for a long period of time and will be definitely delivered to the system in maximum one week. Only a small amount of pentane will be available as a reserve in the plant site.

Drilling fluid will be used for each well that is planned to be opened within the scope of the project. During drilling operations, the waste sludge that may occur and the resulting geothermal liquid; in well locations suitable for the system, the sludge pool that is provided the impervious ground quality will be made and these will be collected in this pool.

Chemicals that will be used as anti-crusting in the facility will be brought to the geothermal well areas privately and their use will be provided as specified in the safety data sheets. Material safety data sheets for the chemicals to be used are given in Annex-16.

III.2.3. Hazardous, toxic, flammable and explosive substances to be used during production in project units, transportation, storage, their impacts during transportation and storage

Dangerous, toxic, flammable and explosive substances shall not be used during the production in planned geothermal power plant units. In case of large-scale failure, during the oil transfer process to be carried out, as a result of accidents that may occur, oil, poured into the environment or overflowing oil, with the absorbents such as sand, gravel or sawdust, the leakage into the environment will be prevented.

In case of use or storage of hazardous, toxic, flammable and explosive substances within the scope of the project, appropriate actions shall be carried out in accordance with the provisions of "Regulation On Measures To Be Taken In Workplaces And Works With Flammable, Explosive, Dangerous And Harmful Substances" which was published in the Official Gazette dated 27.11.1973, numbered 7551 and enacted by being published.

All operations related to the handling, transportation and storage of the various chemicals to be used during the operation of the power plant shall be carried out carefully in accordance with the instructions previously prepared by qualified personnel.

III.2.4. Measures to be taken for heavy metals and toxic chemicals carried by geothermal fluids (arsenic, lead, zinc, boron as well as a significant amount of Carbonate, Silica, Sulfate, Chloride and so on) and gases such as carbon-dioxide and hydrogen-sulfur

While there are no major differences in the content of geothermal fluids in heavy metal, chemical and gas types, their rates may vary depending on the location of the reservoir.

Geothermal fluids include heavy metals and chemicals, as well as non-condensing gases in different amounts. Since the gases in question exist under a certain pressure in the reservoir, they are dissolved in the geothermal fluid.

During the operation phase of the project, emissions from the cooling tower are expected.

CO₂, N₂, CH₄, NH₃, H₂S and H₂ gases are the possible emissions from the operation phase of the project. CO₂, which is approximately 99% by volume, has an important place compared to other gases.

The limit values in Annex-2, Table-2.1. of the "Regulation On The Control of Industrial Based Air Pollution", which was published in the Official Gazette, dated 03.07.2009, numbered 27277 and enacted by being published, have only the limit value of regulation for H₂S.

Table 70. H₂S Air Quality Limit Values

Parameter	Time	Unit	Year				
			2016	2017	2018	2019-2023	2024 and after
H ₂ S	Hourly	µg/m ³	100	100	100	100	100
	STL		20	20	0	20	20

Source: Regulation on Control of Industrial Based Air Pollution

Considering the Air Quality Impact Values obtained by using the AERMOD Model, it is foreseen that the possible emissions to be generated during the operation phase of the project meet the ROCOIBAP limit values and therefore the activity will not pose any danger to human and environmental health. In the modeling study, it is assumed that all plants in the license area are in operation and emission distribution within the framework of the existing technologies, and it is expected that the emission levels will decrease by selecting processes where H₂S treatment efficiency is higher with the developing technologies. The data about the modeling work carried out within the scope of the project are given under the heading of III.2.22.

Within the scope of the project, it is aimed to keep the gas emissions from the facility at the limit values stated in the Regulation on Control of Industrial Air Pollution. Within this scope, necessary analysis and measurements will be got done to measurement firms accredited by the Ministry of Environment and Urbanization. In case of exceeding the limit values of the measurement results; possible technical solutions will be considered to reduce gas emissions.

In order to eliminate the problems that may be caused by the calcite layer in the pipes used during the transportation of the geothermal fluid to the power plant, and to prevent other possible problems, chemical dosing devices shall be used for the delivery of an appropriate inhibitor to the pipe at each well or mechanical cleaning of the pipes. With the system to be installed in each well used, corrosion problems in pipes and contact surfaces will be prevented and operational problems will be prevented.

III.2.5. Properties of machinery, tools, instruments and equipment to be used in project units

The Binary system process to be used within the scope of the planned project is based on the transfer and separation of the geothermal fluid obtained from the production wells to the pressure separators and the transfer of the mechanical energy, which occurred as a result of the tribulation of the steam that obtained in this unit, to the switch site by means of the generators. Machinery and equipment planned to be used in the facility within the scope of the project are listed below.:

- Inhibitor dosing system
- Well head check valves
- Separator
- Balancing tank
- Filters
- Pumps
- Measuring
- Equipment
- Manual valves
- Safety equipment
- Compressor
- Driver panels
- Automation panel

The machinery and equipment to be used in the reinjection wells' wellhead facility are;

- Re-injection pumps
- Manual valves and check valves
- Measuring equipment
- Safety equipment
- Driver panels
- Automation panels
- Frequency controller panel
- Cutting cells
- Transformer

Machine-equipment to be used in the power plant area;

- Heat Exchangers
- Their Recuperators
- Turbines
- Transformer
- Cooling Tower Unit and Accessories
- Diesel Generator Group
- Air Compressors and Equipments
- Field Instruments BOP Scada Automation System
- Fire Detection and Extinguishing System
- LV Distribution - Compensation Panels

III.2.6. After-use evaluation or disposal systems of geothermal source, Number, depths and capacities of reinjection wells to be drilled, Dimensions of the reinjection pool to be used jointly and how long the two power plants can get fluids in case of malfunction/maintenance, Reinjection process of fluid in pool in fault/maintenance process of the power plant

Within the scope of the project, the geothermal waters used as a result of the energy production will be re-injected back to the underground and the reinjection process is important in terms of protecting both the environment and reservoir parameters.

The most important factor determining the efficiency and life span of the geothermal source is the flow of the geothermal fluid to be used in the power plant area at a certain level and amount. Therefore, the reinjection method will be used to prevent the reservoir reduction in the production wells. Thus, the pressure drop and heat loss caused by the reduction of the reserve will be prevented. The facility will not start operation before the reinjection process is put into operation.

During both the production phase and the reinjection studies, attention shall be paid not to damage the freshwater aquifers. As the geothermal fluid used in the facility is re-pressed underground, the water balance of the reservoir will not be disturbed and the pressure of the reservoir will be preserved. The production period of the reservoir will be prolonged by applying the re-press process. Thus, the surface collapses, which occur due to the decrease in the reservoir volume due to the production, will be minimized.

Within the scope of the project, 10 production and 5 reinjection wells are planned to be used. It is not planned to open a new reinjection well.

Information on the reinjection wells to be opened within the scope of the project is given below.

Table 71. Informations On Re-injection Wells

	Row No.	Well Name	Status
Re-injection Wells	1	OB-57	present
	2	OB-61	present
	3	OB-67	present
	4	OB-56A	New
	5	OB-56B	New

Drilling of geothermal resources for their use will reach an average depth of 2.750 m above the ground level.

The power plant area will be supplied with the production wells to be used and the sustainability of the reservoir will be ensured by means of the reinjection wells.

It is aimed to protect the reservoir pressure by the reinjection process, to dispose the remaining water after use and to produce more heat from the reservoir.

As the used fluid is re-pressed into the reservoir, the water balance of the reservoir will not deteriorate and the pressure of the reservoir will be preserved. As the unused hot water will be prevented from polluting the environment, the production period of the reservoir will be prolonged. In addition, the surface collapses, which are a result of the decrease in reservoir volume due to production, will be minimized.

In the case of reinjection wells, a possible failure in the closed circuit of the resource can be seen immediately in the control center with the automation system and can be intervened here. For the possible malfunctions in the reinjection system, a 9,000 m³ storage pool in the existing Efe-2 JES camp will be used. The pool will be able to store 1,500 tons / hour of geothermal resources to be used in the system for approximately 6 hours. In case of prolongation of malfunction, production wells are closed through the automation system and the flow of geothermal resources is stopped. Therefore, no geothermal fluids will be transferred from the facility.

III.2.7. Potential impacts on groundwater during the production and transportation of the geothermal source as a result of its use, and measures to be taken

Geothermal energy is defined as the energy type, which the heated fluids include, in the reservoirs formed by permeable rocks in the depths accessible to the earth's crust.

With this system, where geothermal resources are used, geothermal fluid will be repressed to the geothermal reserves in order to protect the geothermal power plant area as sustainable and to protect the reserve.

The geothermal resource to be used within the scope of the project will come to the power plant area in a completely closed system and will be re-injected to the underground after use. During the opening of the wells, the regulator covers will be used and the mixing of groundwater and drilling fluids to potential aquifers will be prevented. In this context, there will be no mixture or negative impact on groundwater caused by the operation.

In case of a technical problem which may cause geothermal fluid mixing in the production and reinjection wells, immediately measures will be taken to prevent the mixing of the geothermal fluid into the groundwater and the institutions and organisations will be informed as soon as possible.

9.000 M3 storage pool will be used in case the power plant is deactivated as a result of reenjection or any problems related to the power plant. Geothermal liquid will be stored in the mentioned pool until the problem of reenjection is resolved. After the technical problem has been resolved, the water collected in the pool will be transmitted into the receiver environment without being discharged again.

During the works to be carried out within the scope of the project, the provisions of the Law on Groundwater, the Regulation on Protection of Groundwater from Contamination and Degradation, dated 7 April 2012 and numbered 28257, and the Regulation on Water Pollution Control will be followed.

In the construction and operation phase of the project, no material and panel strip will be poured into the surrounding stream beds, no interference in the stream beds, no damage to the existing flood protection structures, no activity that will affect the flow of the stream and the provisions related to the "Stream Beds And Floods" specified in Prime Ministry Circular No.2006/27 shall be complied with.

III.2.8.Impacts on other geothermal sources/the basin depending on the use of the source, and measures to be taken (cumulative evaluation) Holistic mapping and evaluation of the geothermal power plants in Germencik district)

Aydın province has an important potential in terms of geothermal resources. Aydın- It is located between Denizli and Sarayköy district and it has about 70% of the geothermal potential in our country in the collapse area called Büyük Menderes Graben. The most important underground wealth of Aydın is geothermal energy sources. Although in many regions, especially in Germencik-Ömerbeyli geothermal field known as geothermal field in Turkey with the highest temperature to 230 ° C. The geothermal fields in Aydın and the usage conditions of these sites are given as follows.

GEOTHERMAL FIELD NAME	THE NAME OF HEATING OUTPUT	OUTPUT			DRILLING			AREA OF USE	INSTALLED POWER PLANT	THE DOCUMENT OF CHANGE
		Temperature	Flow	Potential	Temperature	Flow	Potential			
YILMAZKÖY	Ilıcabaşı	34-38	1.1		84-142	47	19	In Thermal Spring and In Heating the Facility of Thermal Spring		
GERMENCİK - ÖMERBEYLİ	Ömerbeyli Site				203-232	725	594.83	Electricity Generation and other applications connected to reinjection wells, the Urban Heating and Cooling , the Heating of Greenhouse, the work of drying (fig,grape),the textile industry (Thermal Underwater),cold storage depot, the industrial process heat,the Heating of Thermal Spring and the Facility of Thermal Spring		
BOZKÖY - ÇAMUR	Bozköy Çamur	36-92	4		59-142	280	107	the Heating of Thermal Spring, the Facility of Thermal Spring and Greenhouse	The Thermal Spring	
SALAVATLI	Salavatlı				167-172	93.8	53.79	Electricity Generation and other applications connected to reinjection wells, The Urban Heating and Cooling,The Heating of Greenhouse,The work of drying,the industrial process heat,the Heating of Thermal Spring, the Facility of Thermal Spring	The Thermal Spring	
SULTANHIŞAR	Sultanhisar				145-146	200	89	Thermal Tourism		
MALGAÇEMİR - GÜVENDİK	Güvendik	38	0.5							
ORTAKLAR - GÜMÜŞ		38.7						the Heating of Thermal Spring, the Facility of Thermal Spring and Greenhouse	The Thermal Spring	
SÖKE - SAZLIKÖY	Sazlıköy	27								
KUŞADASI	Ilıca				26	3		the Heating of Thermal Spring, the Facility of Thermal Spring and Greenhouse		
BUHARKENT - ORTAKÇI	Ortakçı	51	0.3							
NAZILLI - GEDİK	Gedik	32			36	1	1			
DAVUTLAR	Davutlar - Karina	26-42								
UMURLU - SERÇEKÖY					124-155	116	143			
ATÇA					63-124	95	35			
PAMUKÖREN					188	58	37			
ÇİFTLİK					58	35	3.37	The Heating, Thermal Tourism		

MTA, 1996* Turkey Geothermal Inventory

MTA,2005*Turkey Geothermal Sources Inventory

DPT,2001**The Geothermal Energy Study Report of Mining Specialization Commission of 8. Development Plan, Subcommission of Energy Basic Materials.

Notes:

1- The potential values in drillings calculated according to total of first generation flows and

2- In high temperatured sites (above 100 °C) according to reservoir temperature.

Figure 105. Geothermal Resources and Their Areas of Usage in Aydın Province

Efe-7 Geothermal Power Plant is planned to be realized within the scope of "Geothermal Resources and Natural Mineral Water Operation License "numbered J-553. The licensing area currently has geothermal power plants operated by the investor company. These facilities and J-553 license area are given as follows.

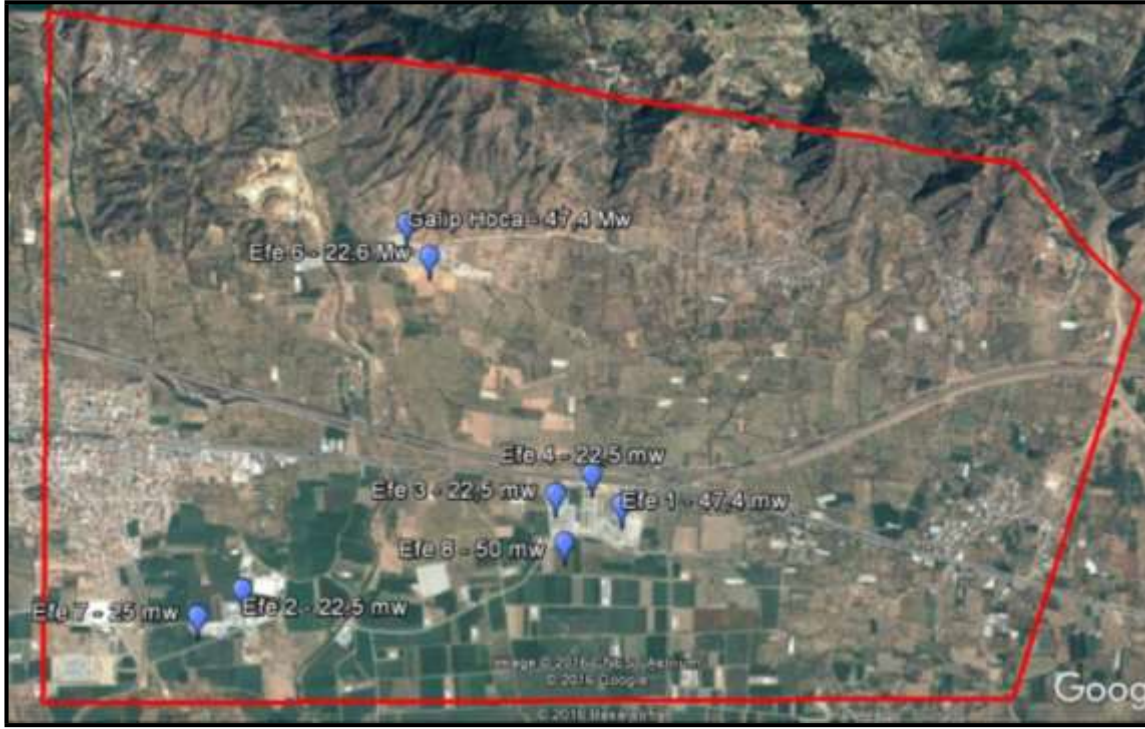


Figure 106. Geothermal Power Plants in J-553 Licensing Area

The dates of purchase of the operation rights belonging to the geothermal power plants which are found in the current situation and planned within the J-553 license area are given as follows

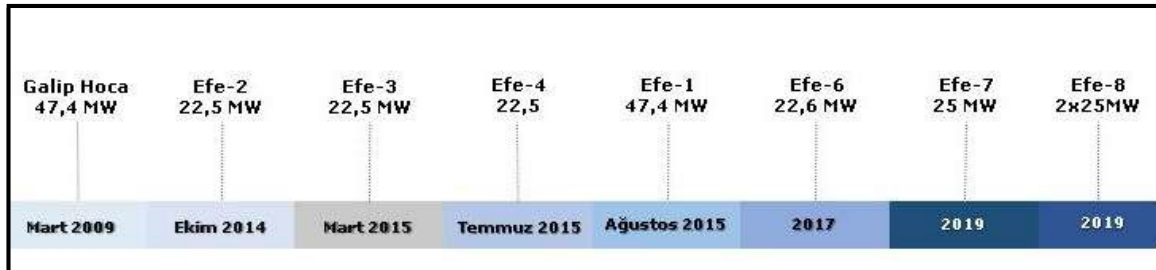


Figure 107. Current and Planned Operation Dates of Geothermal Facilities in the Licensing Area
March 2009, October 2014, March 2015, July 2015, August 2015, 2017, 2019, 2019

In the "Geothermal Resources And Natural Mineral Waters Operation License" area J-553 No., various Geophysical-geotechnical reports, consultancy reports, Social Impact Assessment Report, current situation determination studies and measurement-analysis reports, H₂S measurement report and EIA reports were prepared by the investor firm. In accordance with the scientific data of the planned and existing projects, reservoir utilization status, geological structure of region and integrative evaluations of facilities were evaluated by qualified personnel.

Another study in the field of licensing is “The Consultancy Report of Aydın-Germencik Geothermal Operation License Areas, Geology-hydrogeology - Geophysical Potential Evaluation and Determination of Production/Reinjection Well Locations” prepared by Prof. Dr. Şakir ŞİMŞEK. As a result of the studies carried out, it is aimed to operate the new facilities planned in the license area by obtaining the necessary permits from the relevant institutions / organizations within the scope of the legislation. It is observed that the planned Efe-7 Geothermal Power Plant project will not pose a problem in terms of reservoir usage, in the studies performed.

Within the scope of the project, reinjection wells; the aims of ensuring a certain amount of pressure increase and slowing down on the level of water, preventing land subsidence and slippage, economic investment in reinjection wells and facilities, protection of the environment, preserving the quality of surface water, groundwater and soil were to take into consideration.

During the operation phase, during the activity period; The provisions of the “Regulation on the Control of Odor Forming Emissions”, which was published in the Official Gazette, dated 19.07.2013 and numbered 28712, shall be strictly observed and, if required and / or requested, the emission measurement shall be made to the authorized institutions and shall be submitted to the relevant authority.

In all stages of the activity, the issues stated in the Regulation on Control of Industrial Based Air Pollution, which was entered into force by being published in the Official Gazette dated 03.07.2009 and numbered 27277, shall be complied with, the measures taken shall be taken and the relevant limit values shall not be exceeded.

Other Geothermal Facilities in the Region

According to the Energy Market Regulatory Authority (EMRA) data, the license information in force in geothermal fields in Aydın province, where the project is located, is given in the table below.

Table 72. License Data on Geothermal Fields in Aydın Province

Type	Status	No.	Title	Facility Name	Installed power (mwm)	Installed Power (mwe)
Licence	In force	EG/6619- 2/03596	LİMGAZ ELECTRICITY GENERATION MINING INDUSTRY AND TRADE CORPORATION	Buharkent JES	5	5
	In force	EG/6550- 4/03579	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE CORPORATION	MEHMETHAN JES	24.8	24.8
	In force	EG/6536- 1/03575	BEŞTEPELER ENERGY GENERATION TRADE CORPORATION	Kubilay JES	24	24
	In force	EG/6510/03569	KEN KİPAŞ ELECTRICITY GENERATION CORPORATION	KEN 3 JES	24.8	24.8
	In force	EG/6417- 17/03539	KEN KİPAŞ ELECTRICITY GENERATION CORPORATION	The Ken Kipaş Power Plant	24	24
	In force	EG/6255/03481	TURCAS KUYUCAK GEOTHERMAL ELECTRICITY GENERATION CORPORATION	Kuyucak JES	18.37	18
	In force	EG/6111- 1/03447	ÇELİKLER SULTANHİSAR GEOTHERMAL ELECTRICITY GENERATION CORPORATION	The Çelikler Sultanhisar Geothermal Electricity Generation Facility	13.8	13.8
	In force	EG/6083- 18/03439	KARKEY KARADENİZ ELECTRICITY GENERATION CORPORATION	Umurlu-2 JES	12.37	12
	In force	EG/5898- 1/03395	ÇELİKLER PAMUKÖREN GEOTHERMAL ELECTRICITY GENERATION CORPORATION	Pamukören JES 3	22.51	22.51
	In force	EG/5842- 2/03366	ÇELİKLER PAMUKÖREN GEOTHERMAL ELECTRICITY GENERATION CORPORATION	PAMUKÖREN JES 2	22.51	22.51
	In force	EG/5255/03112	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE CORPORATION	Kerem JES	24	24
	In force	EG/3821-5/2327	MENDERES GEOTHERMAL ELECTRICITY GENERATION CORPORATION	Dora IV JES	17	17
	In force	EG/3821-1/2323	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE CORPORATION	Deniz (Maren II) JES	24	24
	In force	EG/3338-1/2022	KİPER ELECTRICITY GENERATION CORPORATION	Kiper JES	20	20
	In force	EG/3230-2/1957	ÇELİKLER JEOTERMAL GEOTHERMAL ELECTRICITY GENERATION CORPORATION	The Çelikler Pamukören Geothermal Electricity Generation Facility	67.53	67.53
	In force	EG/3094- 11/1845	GÜMÜŞKÖY GEOTHERMAL ENERGY GENERATION CORPORATION	Gümüşköy JES	13.2	13.2
	In force	EG/2756- 11/1704	KARKEY KARADENİZ ELECTRICITY GENERATION CORPORATION	Karkey Umurlu JES	12.37	12
	In force	EG/2709- 12/1680	MENDERES GEOTHERMAL ELECTRICITY GENERATION CORPORATION	Dora III JES	34	34
	In force	EG/2191-2/1538	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE CORPORATION	The Maren Power Plant	44	44
	In force	EG/1435-4/1040	MENDERES GEOTHERMAL ELECTRICITY GENERATION CORPORATION	The Dora-2 Geothermal Energy Power Plant	9.5	9.5
	In force	EG/126-106/43	MENDERES GEOTHERMAL ELECTRICITY GENERATION CORPORATION	Dora-1	7.951	7.951

Source: Energy Market Regulatory Authority, , lisans.epdk.org.tr (license.emra.org.tr), March, 2017

Information on the active geothermal facilities in Germencik district is given in the table below.

Table 73. The Active Geothermal Power Plants in Germencik District

No.	Company Name	Project Location	Project Name	Capacity (Mwe)
1	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE INC.	Aydın Province, Germencik District, Bozköy-Çamur Locality Sinem JES and İrem JES	The Sinem Geothermal Power Plant and The İrem Geothermal Power Plant	20+19
2	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE INC.	Aydın Province, Germencik District, Bozköy-Çamur Village Neighbourhood (J-552 / A License) Mehmethan JES	The Mehmethan Geothermal Power Plant	24
3	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE INC.	Aydın Province, Germencik District, Bozköy-Çamur Village Neighbourhood (J-552 / A License)	The Kerem Geothermal Power Plant	24
4	MAREN MARAŞ ELECTRICITY GENERATION INDUSTRY AND TRADE INC.	Germencik /AYDIN	The Deniz Geothermal Power Plant	24
5	BEŞTEPELER ENERGY GENERATION TRADE INC.	Moralı Village and Uzunkum Village Neighbourhood /Germencik	The Kubilay Geothermal Power Plant	48
6	GÜRMAT ELECTRICITY GENERATION INC.	Mesudiye Neighbourhood /Germencik	The EFE-1-2-3-4 Geothermal Power Plant	162,5
7	GÜRMAT ELECTRICITY GENERATION INC.	Ömerbeyli Neighbourhood /Germencik	The Galip Hoca Geothermal Power Plant	47,4

The active geothermal power plants given in Table.73 are processed on the satellite view below.

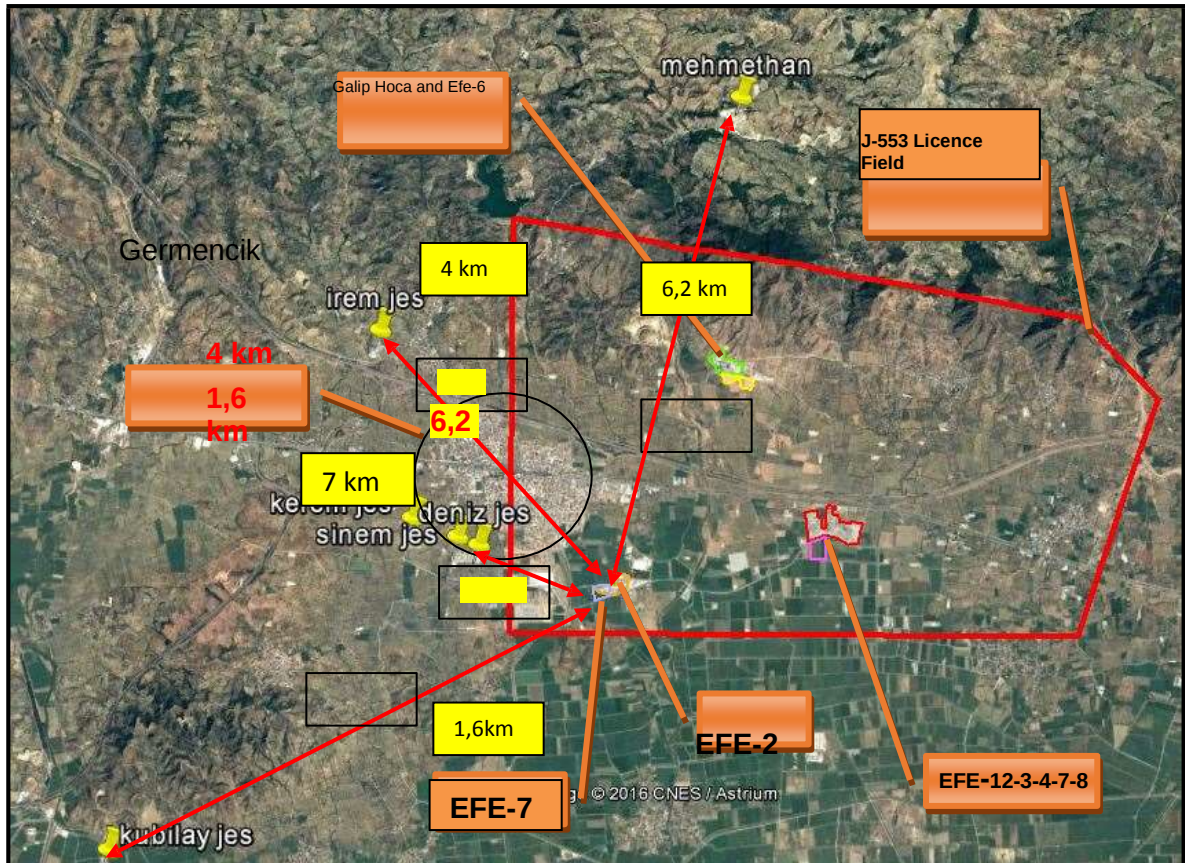


Figure 108. Geothermal Facilities in Germencik Region

According to MTA-2005 data ,geothermal fields in the district of Germencik are given as the point below.

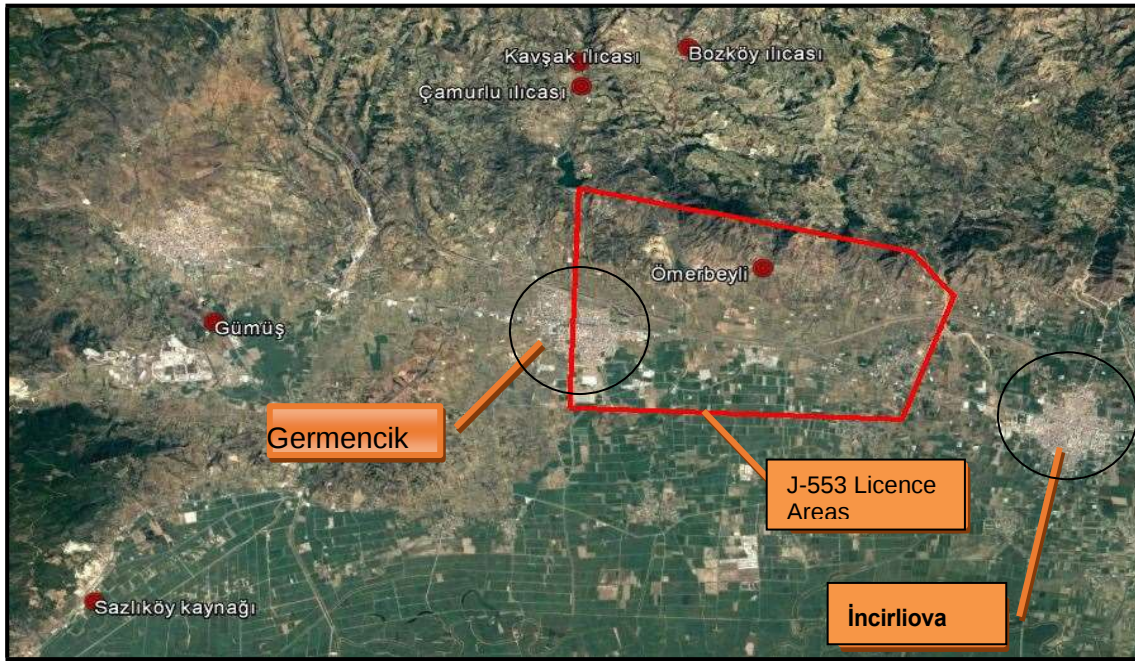


Figure 108. Geothermal Resources in Germencik District

Source: Geothermal Resources Inventory, 2005. MTA Publication

The study performed in the field of licensing is “The Consultancy Report of Aydın-Germencik Geothermal Operation License Areas, Geology-Hydrogeology - Geophysical Potential Evaluation and Determination of Production/Reinjection Well Locations” prepared by Prof. Dr. Şakir ŞİMŞEK.

The study performed in the field of licensing is “The Consultancy Report of Aydın-Germencik Geothermal Operation License Areas, Geology-Hydrogeology - Geophysical Potential Evaluation and Determination of Production/Reinjection Well Locations” prepared by Prof. Dr. Şakir ŞİMŞEK.

The study performed in the field of licensing is “The Consultancy Report of Aydın-Germencik Geothermal Operation License Areas, Geology-Hydrogeology - Geophysical Potential Evaluation and Determination of Production/Reinjection Well Locations” prepared by Prof. Dr. Şakir ŞİMŞEK.

In this context, the detailed geology, hydrogeology and potential evaluation studies of geological, the detailed determination of hydrogeological and geological characteristics of wells and deep production/reinjection drilling well locations / wells and wells and wells to be opened for the purpose of developing the licensed Germencik geothermal operation area and for sustainable use of the field were evaluated.

In the mentioned report; the scope of geology, hydrogeology, hydrogeochemistry, geophysics, potential evaluation services for the development of the Germencik geothermal field cover the following topics.

1 - Examining all the data in the field and evaluating the field in terms of geological, hydrogeological and hydrogeochemical aspects, preparation of maps, section and block diagrams,

2- Examining geophysical gravity, resistance, seismic and so on. measurement and maps and cross sections, by combining new additional studies, the preparation and evaluation of geophysical maps and new maps and sections with entering well informations to the cross sections and application of new geophysical methods (Mt etc).

3-Formation of conceptual hydrothermal model,

4-Evaluation of field potential

5-Determination of vertical and / or directional exploration / production / reinjection drilling well locations,

6-Preparing the probable well logs related to the drillings to be made and in these logs;

a- The depth of the wells,

b- The lithological properties of the rock units to be cut, especially the effects of hardness and progress on drillings

- c- The thickness of the units,
- d- Production fracture and fault zones to be provided
- e- Specifying reservoir zones suitable for possible mud leakage and production,
- 7- Determination of starting and ending coordinates and possible deviation points and slope degrees of directional drilling
- 8- Investigation of the relationship between the license area and the surrounding areas,
- 9- Evaluation of the development of the site,

In line with the above stated purpose, all studies were reviewed and general evaluation was made, search / production and reinjection well locations were proposed, well properties were determined and suggestions were made for the development of the site.

Regarding the geothermal model formation in the field, the evaluations regarding the reservoir, the seal rock, feeding and heat source and the prepared geothermal model data are given below.

Geothermal reservoirs (reservoir rock): 2 reservoirs (reservoir rock) were determined as a result of exploration drillings made in Germencik Geothermal Area. These reservoirs are formed by the stepped fault system formed under heavy graben tectonics and secondary porosity and permeability of hard and brittle lithologies.

I. Reservoir: It is formed within the Miocene units at levels close to the basement with faulted, fractured-fissured hard conglomerate levels. In the area of Germencik I. In terms of yield and temperature in terms of electricity production of the reservoir, II. It is not seen as widespread and operateable compared to the reservoir. However, this unit may have a quality of the high temperature and efficient reservoir under the cover at some locations in the southern part of the site.

II. Reservoir: In the 2nd. Reservoir, which considered in the field widely and economically suitable for electricity production, 216-239 in the 51°C temperatures measured. More secondary porosity and permeability are improved than I. Reservoir, and the yield is higher in wells producing from this Reservoir.

Seal rock: In the wells drilled in the study area, 2 seal rock assemblages were determined which separated the reservoirs and had impermeable properties.

I. Seal Rock: The lithologies of Pliocene-Pliocuvian and Miocene units, which are widely observed as continental-lacustrine sedimentary rocks in Germencik region, which presents sandstone-milestone-claystone alternation properties, are impermeable. Although claystones and milestones have high porosity, their permeabilities are almost non-existent. In addition, in other hard and brittle lithologies during grabenization, secondary permeability developed while these units retained their fluid and heat conductive properties. Thickness of the Omerbeyli Fault to the south from 100 to 1400m to the south and further increases. This is seen in the fence diagram.

II. Seal Rock: Miocene base, allochthonous gneiss and schist levels belonging to the foundation form the second seal rock. Thickness varies between 300-500m. When the first reservoir is neglected and the first and second rock are evaluated together, the calculated thicknesses vary between 730-1279m from the northernmost well to the southernmost well.

Feeding: The feeding hinterland of the geothermal area is very wide. Geological, geomorphological, tectonic and hydrogeological conditions of the Bozdağ, Kızılcagedik and Koçarlı horst and the Büyük Menderes graben in the feeding area were investigated.

Büyük Menderes valley watershed line is regional and very wide. To determine a feeding area for the Germencik geothermal field, it is necessary to evaluate the surrounding area of the site. The main source of the feeding of the geothermal reservoirs is the sum of the meteoric waters falling into the basin and the surface and groundwater that come into the basin. The feeding of reservoirs in the study area is closely related to the permeability of lithologies in horsts and grabens.

Geological, hydrogeological, geochemical and geophysical data obtained from the field were evaluated and a conceptual geothermal (hydrothermal) model was formed. According to this; Germencik and hot and mineral waters developed in the underground, due to the geothermal gradient of meteoric origin waters, which are filtered from underground to rain and snowfall, are formed as a result of elevations along fractures and the fault lines.

The granitic magma approach (heat source), which provides a high local geothermal gradient in the field, was estimated to be 900 ° C at a depth of about 9 km.

The geothermal potential of the region is given in accordance with the consultancy report prepared as follows.

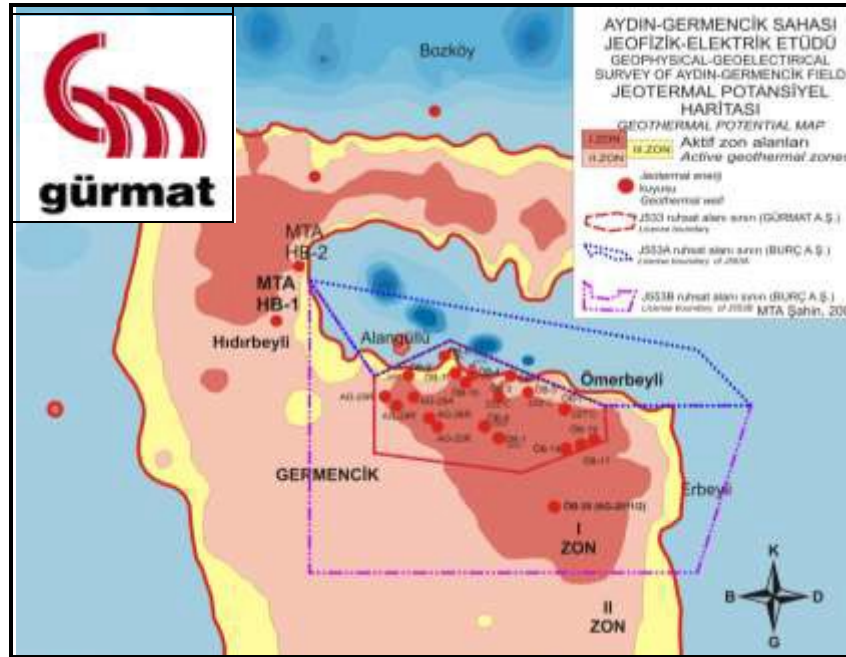


Figure 110. Geothermal Potential Map of the Project Area and its Surroundings

Source: Aydın-Germencik Geothermal Operation License Areas Geology-Hydrogeology-Geophysical Potential Evaluation and Production / Reenjection Well Location Determination Consultancy Report, Prof.Dr. Dr. Şakir Şimşek, April, 2012.

Diagrams, maps and sections prepared for geothermal sources and groundwater related to the hydrogeological characteristics of the region are given in the heading of "II.2.3. Hydrogeological Properties"

Cumulative H₂S modeling of facilities owned by the investor company in the J-553 license area under the project are given in the heading of "III.2.22. The Existing Pollution Load of The Region And The Other Geothermal Power Plants Located In The Same Region And / Or Planned To Be Established, Evaluation of The Possible Effects of The Power Plant"(Livings, Air, Water, Soil) .

In the operation phase of the project ,the gas, which will be given to the atmosphere from the cooling tower and given its limit values in Table 2.2 of the Regulation On Industrial Based Air Pollution Control, is the hydrogen sulphide (H₂S) gas. Within the scope of cumulative impact assessment studies, the model study was carried out by evaluating the case of working together the Efe 1-2-3-4, Galiphoca Jes, and Efe-7 and Efe-8 projects planned for the ongoing construction of Efe-6 projects.

Considering the Air Quality Impact Values obtained by using the AERMOD Model, it is foreseen that the possible emissions to be generated during the operation phase of the project meet the ROCOIBAP limit values and therefore the activity will not pose any danger to human and environmental health. In the modeling study, it is assumed that all power plants in the license area are in operation and it is foreseen the emission distribution in current technologies. The emission distribution is expected to be decreased by choosing the processes with higher efficiency of H₂S treatment together with the developing technologies.

It is very important to keep the gas emissions from the geothermal power plants located in Germencik district at the limit values stated in the Regulation on Control of Industrial Based Air Pollution. The air quality measurements and noise related measurements are carried out by the Investor firm Gürmat Electricity Generation Inc. to determine the current situation. The measurements realized in and the samples taken from the J-553 license area were carried out by accredited authorized laboratories. In this respect, necessary analyzes and measurements will be carried out by the accredited laboratories on a regular basis, and measures will be taken if necessary, based on the measurements taken as a result of the measurements.

In accordance to the realization of the geothermal power plants' measurements related to the parameters specified in the legislation through accredited authorized laboratories; it will be contributed to be able to take necessary measures to monitor, control and minimize the impacts of geothermal power plants in the region.

III.2.9.Potential impacts on the soil layer as a result of the use of the geothermal source, assessment of risks such as collapse or potholes

With the technology to be used within the scope of the project, geothermal fluid will operate cyclically in a closed system. Loss of geothermal resources is expected to be minimal with the reinjection system. In this context, risks such as drain or pothole are eliminated.

If any technical problems are encountered during the operation phase, the pool will be used. In this way, it will be provided to storage the geothermal fluid, until the problem resolved. Once the problem has been cleared, the pooled water will be returned to the re-injection system without being discharged to any receiving environment. Under favor of the technology to be used and the measures to be taken, the affection of the physical structure of the soil will be prevented as a result of the use of geothermal resources.

III.2.10. Potential impacts during the cleaning of existing wells or reactivation of unused wells, and measures to be taken

In order to eliminate the problems that may be caused by the possible calcite layer in the pipes used during the transportation of the geothermal fluid to the power plant, and to prevent other possible problems, chemical dosing devices shall be used for the delivery of an appropriate inhibitor to the pipe at each well or mechanical cleaning of the pipes. With the system to be installed in each well used, corrosion problems in pipes and contact surfaces will be prevented and operation problems will be prevented. The selection of the cleaning technique will be determined in detail projecting with the completion of the well tests.

The geothermal fluid collected by the pipelines will be conveyed to the separation station to be separated under a certain pressure and the steam obtained will be used in the cycling of the turbines, and the remaining pressure and the fluid, which lost its heat, will be pressed to the reinjection wells by reinjection pumps and pipe system. Thus, the geothermal fluid will be transported back to the ground without damaging the environment and thus the geothermal resource will be protected and the reserve's sustainability will be maintained.

Geothermal fluid will not be released to the environment during the works of well cleaning or reproduction of the unused wells. Geothermal fluid will be stored until the system is reactivated by using an impermeable emergency pool and will be re-pressed to the reservoir with the reinjection wells without discharging to any receiving environment with the reactivation of the system.

In case of production from a new well in addition to the wells to be used, technical issues such as the adequacy of the capacity of the reinjection system will be evaluated before production from this well. In case of capacity increase and / or planning of a new well in the project, necessary actions will be taken in line with the EIA Regulation.

III.2.11. How much water to be used in project units for which processes Characteristics of wastewater to be generated, how to dispose it

There will not be any water use other than the drinking and service water required for personnel to be employed and the irrigation water of roads used by periodic vehicles in the operational period of the planned project.

The wastewater generation from the personnel to be employed in the operation period of the project will be in question. Domestic wastewater, which will emerge during the operation phases of the project, will be collected in septic tank and will be disposed of with a specific sewage truck. The letter that the domestic wastewater will be taken by the Aydın Metropolitan Municipality by sewage truck is presented in Annex-21.

Within the scope of the project, the drinking water required by the personnel will be provided through carboys. The "Regulation on Water for Human Consumption Purposes", which was put into force by being published in the Official Gazette ,dated 17.02.2005 and numbered 25730 (Amendment: OG-31.7.2009-27305, OG-7.3.2013-28580, OG-11.4. 2014-28969) shall comply with the provisions. The letter to be provided for service water by Aydın Metropolitan Municipality is presented in Annex-22.

Within the scope of the project, approximately 1,500 tons / hour geothermal fluid to be produced from 10 production wells will be used in Efe-7 Geothermal Power Plant. Then, with 5 reinjection wells, 99% of the fluid used will be repressed.

During the operation phase of the power plant area, no industrial wastewater will be generated within the facility.

All aspects of the Regulation on Control of Water Contamination, which was published in the Official Gazette, dated 31.12.2004, numbered 25687 and enacted by being published, shall be complied with during the disposal of the liquid wastes that will occur during the construction and operation phases of the project.

III.2.12. Quantities and characteristics of solid wastes to be generated during the operation of the plant, disposal processes, and measures to be taken

Domestic Solid Waste

Domestic solid waste generation from the personnel working during the operation phase of the project will occur. During the operational phase of the project; the amount of solid waste generated by the acceptance of the amount of solid waste produced per person per day is 1.16 kg / day 30 in case of 8 person work.

Amount of domestic solid waste produced is calculated as
$$= 8 \text{ people} \times 1,16 \text{ kg / day-person}$$
$$= 9.28 \text{ kg / day.}$$

Domestic solid wastes generated from personnel during the operation phase of the activity; according to their qualifications within the project area (organic, glass, plastic, paper, metal, etc.), they shall be collected in separate containers and shall be kept in sealed containers such as appearance, dust, odor and similar factors so as not to pollute the environment. These solid wastes to be collected in containers will be collected and disposed of by the garbage collection vehicles of Germencik Municipality in certain periods.

The provisions of the "Waste Management Regulation", which was published in Official Gazette ,dated 02.04.2015, numbered 29314 and enacted by being published, shall be complied with during the collection, storage and transportation of domestic solid wastes.

Packaging Waste

The wastes that can be recovered during the operation phase of the project ,in accordance with the "Regulation on Control of Packaging Wastes" , which was published in the Official Gazette dated 24.08.2011,numbered 28035 and enacted by being published and within the framework of all amendments in this regulation; will be collected separately from the other solid wastes and will be delivered to the company at certain intervals within the scope of the contract to be made with the company having the packaging waste collection license.

In accordance with the provisions of the Regulation on Soil Pollution Control and Point Source Contaminated Sites (Amended: OG-14.6.2012-28323, OG-11.7.2013-28704), which was published in the Official Gazette dated 08.06.2010,numbered 27605 and enacted by being published, will be moved.

Waste Oil and Hazardous Waste Formation

No waste generation due to maintenance and repair activities will be observed in the facility and will be taken to the temporary waste storage area in the switchyard if it occurs, and then disposed within the framework of the relevant regulations.

Within the scope of all works to be carried out in the project area, shall be acted in accordance with the provisions of "Regulation on Control of Waste Oils", which was entered into force by being published in the Official Gazette, dated 30.07.2008 and numbered 26952 (Amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013 -28 812).

³⁰ Source: TURKSTAT (TÜİK), www.tuik.gov.tr, 2014

The maintenance and repairs to be carried out within the project area will be carried out in a sealed area and the "Regulation on the Control of Soil Pollution and the Point Source Contaminated Fields" ,which was published on the Official Gazette dated 08.06.2010, numbered 27605 and enacted by being published (Amended: OG-14.6 .2012-28323, OG-11.07.2013-28704) shall be complied with,during the works to be carried out.

The provisions of the "Waste Management Regulation", which was published in the Official Gazette, dated 02.04.2015 ,numbered 29314 and enacted by being published,will be complied with for hazardous wastes likely to occur at all stages of the project.

Waste Batteries and Accumulators

Since the maintenance and repair of the vehicles and equipment to be used within the scope of the operation of the project will be carried out at the authorized service stations outside of the activity site, the battery changes will also be made outside the facility. Waste accumulators formed will be given to the service station where the new accumulator is taken.

In case of an emergency situation, if the battery changes are made inside the facility,the possible waste accumulators will be temporarily stored in a sealed and closed environment and will be disposed of by recycling to a recycling / recovering company licensed by the Ministry of Environment and Urbanization and disposed in accordance with the provisions of the "Regulation on Control of Waste Batteries and Accumulators",which was entered into force by being published in the Official Gazette, dated 31.08.2004 and numbered 25569 (Amendment: OG-03.03.2005 / 25744, RG -30.03.2010 / 27537, OG-5.11.2013-28812, OG- 23.12.2014-29214).

The provisions of the "Regulation on Control of Waste Batteries and Accumulators "(and all amendments to the regulation), which came into force by being published in the Official Gazette, dated 31.08.2004 and 25569 numbered, and "Regulation on the Regular Storage of Wastes", which was published in the Official Gazette ,dated 26.03.2010 and numbered 27533 and put into force on 01.04.2010 (Amended: OG: 11.03.2015 - 29292) shall be observed.

End of Life Tires

The vehicle tires which are likely to result from the vehicles to be operated during the operation phase of the activity will be stored temporarily in a sealed and closed environment and will be provided to the recycling / recovering company licensed by the Ministry of Environment and Urbanization, according to the "Regulation on Control of End of Life Tires" ,which was dated 25.11.2006 and numbered 26357 (Amended: OG-30.03.2010-27537, OG-10.11.2013-28817,OG-11.3.2015-29292).

Medical waste

During the operation phase, the personnel who will be working in case of any accident will be provided with medical equipment capable of first intervention; no medical interventions, such as injection, suture, medical treatment will not occur.That's why, cutter and penetrative medical wastes will not occur. In case of more severe injuries and accidents, the health facilities located in the nearest settlements shall be promptly dispatched. In this context, although the amount of wastes in the plant cannot be determined, it is estimated that there will be a very small amount.

All medical wastes likely to occur in the facility; resistant to tear, puncture, explosion and transportation, medium-density polyethylene raw material, double-bottom and seamless non-welded, double-layer thickness 100 micron, with a minimum lifting capacity of 10 kilograms, large enough to be seen on both sides and black on both sides m m With the emblem of "International Biohazard" and with the phrase of "ATTENTION! MEDICAL WASTE" red plastic bags will be used. The bags will be filled at a rate of mazlık at most and their mouths will be tightly bonded, and if necessary, each bag will be put into another bag with the same properties and a definite seal will be provided. The contents of the medical waste bags will not be compressed in any way, the medical wastes will not be removed from the bag, unloaded and transferred to another container.

The cutter and penetrative wastes will be collected in plastic or similar carton box or containers, which have similar qualities and are made from laminated carton, which are punctured, torn, broken and explosion-proof, apart from other medical wastes, waterproof and leak-proof, cannot be opened and mixed, and are written in black letters with the emblem of "International Biohazard" and with the phrase of "Attention! Cutter and Perforator Medical Waste" These reservoirs shall be filled at a rate of ¾ most, their mouths shall be closed and placed in medical waste bags. After the cutter-penetrative waste containers will not be pressed, opened, emptied.

The provisions of the "Regulation on Control of Medical Wastes", which entered into force by being published in the Official Gazette dated 25.01.2017 and numbered 29959, shall be observed in all stages of the project.

III.2.13 Quantities and characteristics of gas wastes to be generated during the operation of the plant, its impacts on the air quality region, disposal processes, and measures to be taken

Greenhouse gases are compounds that support the greenhouse effect, are in the atmosphere and have the most heat retention properties.

The Earth's atmosphere consists of various gases. There are also some inert gases in small quantities. The rays from the sun (heat rays / short wavy rays) heat the earth by passing the atmosphere. The gases in the atmosphere keep some of the heat on the earth and prevent the heat loss of the earth. The atmosphere has the ability to pass light and keep heat. The temperature of the water remains stable under favor of the ability of the atmosphere to retain heat. Thus, freezing of rivers and oceans is prevented. In this way, the heating and insulation effect of the atmosphere is called "Greenhouse effect".

The main greenhouse effect gases in the world are 36-70% Water vapor, 9-26% Carbon dioxide, 4-9% Methane and 3-7% Ozone. Some of the greenhouse gases are formed by themselves, while others are produced by humans.

Naturally generated greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide and ozone. As a result of human activities, there are additions to these gas levels and as a result greenhouse effect is observed.

Emissions from the cooling tower are expected during the operation phase of the project.

Geothermal fluids contain heavy metals and chemicals, as well as different amounts of non-condensable gases. Since these gases are present in the reservoir under a certain pressure, they are dissolved in the geothermal fluid. The content of non-condensable gases released during operation of the Geothermal Power Plant; CO₂ can be listed as N₂, CH₄, NH₃, H₂S, O₂ and H₂. Approximately 99% of the volume of CO₂, in the amount of traces of other gases are involved.

Developments on technology and industry and increasing population, our world is faced with intense energy demand. This demand is largely met by fossil sources. But if we take into account the danger of extinction of fossil fuels as well as the damage to the environment, it is inevitable to turn to alternative energy sources. One of the most important of these resources is geothermal.

The projected geothermal power plant and the carbon dioxide emission data for the energy production types are given in Table.74.

Table 74. Energy Production Types and CO2 Emissions

Power Plant Type	Lowest CO2eq / kWh	Average gCO2eq / kWh	Highest CO2eq / kWh
Currently available commercial technologies			
Coal – Combustible	740,00	820,00	910,00
Gas – Combined Cycle	410,00	490,00	650,00
Geothermal	6,00	38,00	79,00
Hydroelectric	1,00	24,00	2.200,00
Wind – Sea	8,00	12,00	35,00
Nuclear	3,70	12,00	110,00
Wind – Land	7,00	11,00	56,00
Pre-Commercial Technologies			
CCS - Coal – Combustible	190,00	220,00	250,00
CCS -Gas - Integrated Combined Cycle	170,00	200,00	230,00
CCS -Gas - Combined Cycle	94,00	170,00	340,00
CCS -Gas - Oxy Fuel	100,00	160,00	200,00

Source: Intergovernmental Panel on Climate Change (HDIP) / Intergovernmental Panel on Climate Change, (IPCC)

gCO2eq / kWh: Kilowatt Watt per hour equivalent to gram Carbon Dioxide

CCS: Carbon capture and storage

The geothermal power plant project, which is the subject of the project, generates much lower CO2 emissions compared to the energy plants that obtain electricity by using fossil fuels. It is observed that the emission emission is less than that of coal and natural gas power plants.

The investment issue of the JES project will be evaluated in terms of the determination of greenhouse gas emissions; The Regulation on the Follow-up of Greenhouse Gas Emissions "published in the Official Gazette dated May 17, 2014 and numbered 29003 does not fall within the scope of the activities listed in the Annex-1 list.

Air quality measurements and noise measurements are carried out by the investor to determine the current situation. The measurements and the samples taken from the J-553 license area were carried out by accredited authorized laboratories.

The Regulation on Control of Industrial Air Pollution Resmi entered into force by being published in the Official Gazette dated 03.07.2009 and numbered 27277 in all stages of the project and the regulation; OG-30.03.2010-27537, OG-10.10.2011-28080, OG-16.04.2012-28263, OG-16.06.2012-28325, OG-10.11.2012-28463, OG-20.12.2014-29211 numbered changes shall be observed.

III.2.14. Vibration because of the project, sources and level of noise, and measures to be taken

During the operation phase of the project, all the machinery and equipment that will cause noise will be regularly maintained and renewed after their economic life. In addition, employees working in the facility will be provided with personal protective equipment (headphones, etc.) and internal control will be carried out at certain intervals to ensure continuous control.

Pump, generator and so on., they will not cause any noise formation that will negatively affect the project area and the immediate surroundings as the equipment will be in the closed area.

In parallel with the technological developments, it is expected that the noise that will be generated in the facility will decrease to a much lower level than the calculated values. Also; maintenance and controls will be carried out periodically to reduce the noise level. The damaged parts will be replaced in time.

In the field of activity, protective equipment (headphones, ear plugs, etc.) specified in the "Labor Law" shall be used regularly by the workers. In every stage of the activity, the "Regulation on Evaluation and Management of Environmental Noise", which was enacted by being published in the Official Gazette, dated 04.06.2010 and numbered 27601 (Amended: OG-27.4.2011-27917) will be studied.

When the Environmental Permit and License Regulation (Amendment: OG dated 12.09.2014 and numbered 29117), which was enacted by being published in the Official Gazette dated 10.09.2014 and numbered 29115, was examined and it is determined that this Geothermal Power Plant was not entered to the lists of Annex-1 and Annex-2 of the mentioned regulation. Therefore, it will be applied to the Ministry of Environment and Urbanization for the noise exclusion permission opinion.

III.2.15. Quantities and characteristics of radioactive waste, measures to be taken

No radioactive material formation is expected within the scope of the project.

III.2.16. Impacts on forest areas and measures to be taken against these impacts

The project area is not within the forest area. The closest forest area to the Project area is 1.5 km.

Necessary measures against possible negative impacts on forest areas are listed below;

- 1) The personnel to be employed within the scope of the project will be trained on the subject of fire.
- 2) It will be acted in accordance with Fire and Emergency Plan against possible forest fires.
- 3) The staff will be prevented from burning fire in the field and throwing flammable substances to the field.
- 4) In the event of a fire, the nearest forest authority or police will be informed.
- 5) Fire extinguishers and equipment will be placed in the working area against a possible fire.
- 6) Excavation and moulding operations shall not be performed on forested areas.
- 7) The roads that will be used to minimize the dust emission due to excavation works during construction operations will be irrigated and wetted by spraying with arazose. Thus, dust emission, which occurs during transportation, will be minimized.

III.2.17. Impacts on agricultural areas and measures to be taken against these impacts

Within the scope of the planned Efe-7 Geothermal Power Plant project; the report named “Determination of the Effects of Surrounding Olive Trees on the Vegetative and Generative Development of the Geothermal Power Plant Project” and prepared by Associate Professor Doctor Mücahid Taha Özkaya from Ankara University, Faculty of Agriculture is presented in Annex-24.

In the report; as a result, it is observed that there is no harm in olive trees and fig trees due to geothermal fluid and geothermal fluids arising from geothermal drilling wells. It is thought that in the production stages of geothermal power plants, which will be established in the future in the region, will have a similar result for the fig and olive trees and will not cause any harm.

By disposing the solid and liquid wastes that will occur during the operation within the framework of the relevant legislation, underground and surface water resources and soil pollution will be prevented.

The geothermal fluid used in the operational phase of the planned project will complete the process in a closed cycle and will not interact with the soil. In case of a technical problem during the operation phase of the project, emergency pool will be used. The geothermal fluid will be stored until the system is reactivated and it will be transferred to the reservoir with the reinjection wells without discharging into any receiving environment and interacting with the groundwater. Due to the technology to be used and the measures to be taken, the physical and chemical structure of the soil will not deteriorate as a result of the use of geothermal resources and there will be no negative impact on the vegetation in agricultural areas.

Excessive excavation material and panel strip-like wastes that will not be used within the scope of the project will not be poured into the creek bed and existing flood protection structures will not be damaged.

During construction and operation phase; Under the 11th and 12th articles of the Aquaculture Regulation and 20th article of Aquaculture Law No. 1380, no harmful substances will be poured into the receiving environment and no water pollution will be caused.

In the construction phase, in the activity field, the topsoil layer will be stripped first. This layer shall be stored in the vegetable storage area for the purpose of surface coating in the subsequent landscaping works separately from the excavation surplus material, in scope of its technic and shall be reused in the restoration works after the construction is completed.

The topsoil to be used in landscaping works will be stored according to the following method;

- If the soil is not used immediately and it is necessary to store it for a long time, the vegetative soil depots will be protected against erosion, drying and weed, it will be covered with vegetation of grass, meadow and pasture plant and so on. on purpose of revival of soil.

- Vegetation and excavation surplus material to be formed within the scope of the project will not be poured into dry river beds and surface waters. The necessary drainages will be made to prevent the stored topsoil from flowing into the surface water.

Necessary permissions to non-agricultural use of agricultural fields in the scope of the project will be obtained from Aydın Gıda, Provincial Directorate of Ministry of Food, Agriculture and Livestock and / or Ministry of Food, Agriculture and Livestock, in accordance with the provisions of the Law on Soil Protection and Land Use No. 5403, which came into force after being published in the Official Gazette, dated 19.07.2005 and numbered 25880 .

III.2.18. Measures To Be Taken on Flora / Fauna

The fact that the project area is an agricultural land, the wide spread of natural plant species, the abundance of these species in the areas around the plant area, the lack of their endangered status and endemic plants, shows that the effects on the plant species in terms of flora can be very low. In order to further reduce this impact, during the construction activities, it will be ensured that the stripped topsoil will be stored and used in landscaping applications to be carried out during the operation phase of this topsoil.

Within the scope of the project, the system will operate in a closed manner and there will not be any discharge to the receiving environment. The facility will be surrounded by wire-mesh fence to prevent the entrance of the fauna elements into the area.

In all stages of the project, the Land Hunting Law No. 4915 and the relevant regulations will be complied with.

During the operation phase of the activity, necessary warnings will be made to the personnel who will work in the project in order not to cause any damage to the fauna species which may come to the field of activity from the surrounding natural environment.

The provisions of the Bern Convention and the CITES Convention (Convention on the International Trade of Endangered Wild Plant and Animal Species) shall be observed.

III.2.19. Determination of potential impacts on underground and aboveground cultural and natural assets, and measures to be taken

Within the scope of the construction phase of the project, which is planned to be realized, no flammable, explosive substances will be used. Work machines will be used for the work to be done.

In the 1 / 100.000 scale Aydın-Muğla-Denizli Environmental Plan of Planning Region given in Annex-2, there are no archaeological areas and protected areas.

The most important effect that may arise from the works within the scope of the project is dust emission from excavation works and it is aimed to eliminate this effect by taking measures such as irrigating the land and covering the materials. Therefore, it is not expected that there will be any negative impact on the possible cultural and natural assets in the underground and overground.

In the opinion of Aydın Regional Directorate of Cultural Heritage Protection Board stated in Annex-23, it is stated that Efe-7 Geothermal Power Plant Project does not exist in any registered archaeological or protected area in terms of cultural existence of the Law No. 2863 on Protection of Cultural and Natural Property.

The project site is not a site covered by the Law No. 2863 on the Protection of Cultural and Natural Assets. If any archaeological remains are encountered in the works to be carried out within the scope of the project, the works shall be stopped immediately and the relevant institution shall be informed.

III.2.20. Where and how to meet the housing and other technical/social infrastructure needs of the staff and the population affiliated to this staff during the operation of the project; Amounts of waste water generated from drinking and use, how to dispose Quantities and characteristics of solid wastes to be generated, How to dispose these wastes

The planned project is planned to employ approximately 250 people during the land preparation and construction phase, and 8 people during the operation phase, and personnel needs will be provided primarily from the settlements in the vicinity of the project area.

As the daily needs of the personnel to be employed within the scope of the project will be provided from the settlements located in the vicinity of the project area, an additional income source will be provided for the local people.

The social needs of the personnel to be employed shall be met in the administrative building to be established at the project site.

The wastewater, which is likely to occur during the construction and operation phase of the project, will be collected in a sealed septic tank and will be disposed of with a sewage truck in certain periods. The letter that the domestic wastewater will be taken by the Aydın Metropolitan Municipality by sewage truck is presented in Annex-21. The letter to be provided for service water by Aydın Metropolitan Municipality is presented in Annex-22.

Domestic solid wastes generated by personnel within the scope of the project; collect in such a way that they will not pollute the environment. These solid wastes to be stored in containers will be provided to the transportation to Germencik Municipality solid waste vehicles in certain periods.

III.2.21. Activities risky and dangerous for human health and environment during the operation of the project

During the operation phase of the Efe-7 Geothermal Power Plant project, the impacts on human health are occupational accidents and potential health problems at the construction site. In order to minimize these impacts, all necessary measures will be taken within the framework of Regulation on Occupational Health and Safety.

During the operation phase of the Efe-7 Geothermal Power Plant project, the impacts on human health are occupational accidents and potential health problems at the construction site. In order to minimize these impacts, all necessary measures will be taken within the framework of Regulation on Occupational Health and Safety.

The fact that the personnel to be employed during the operation phase are trained and have a qualification certificate is one of these measures. In addition, the working hours of the staff will be limited to eight hours. Measures to be taken in order to reduce the risk of human and environmental impacts include accident, fire and safety. Security measures will be taken in the facility area and the guard will be kept continuously.

There will be sufficient tools and equipment in the facility to be used in any fire and similar natural disasters in and around the site. Thus, in case of any fire, the fire will be intervened as soon as possible. In addition, all kinds of precautions will be taken against the possible accidents in the related regulations. First aid in respect of accidents that may occur in the facility will be made primarily with the health supplies to be kept in the facility. In case of more severe injuries and accidents, it will be sent to the health facilities in the nearest settlement urgently.

Vehicles operating in the field within the scope of the project constitute a risk of danger and accident for human health. In order to minimize the risk of accidents, maintenance of the operating vehicles will be carried out periodically, all kinds of environmental safety will be taken in the field and the necessary warning signs will be placed.

In the operational period of the project, there is a risk of occupational accidents due to human health. In terms of environment, risky and dangerous situations may arise if noise, air emissions, solid and liquid wastes are not disposed of properly and necessary precautions are not taken.

In order to prevent all possible risks to human health at all stages of the project, all the health and safety rules determined by the regulations and the relevant legislation of the Occupational Health and Safety Law No. 6331 in occupational health and safety will be complied with. Within the scope of the project, the Law on General Hygiene Law No. 1593 and the regulations and directives to be issued pursuant to these laws shall be complied with.

III.2.22. Current pollution load of the region, and assessment of potential impacts of the power plant (on living creatures, air, water, soil) along with other existing and/or intended geothermal power plants

Air Quality ³¹

As a result of urbanization brought by modern life, air pollution has either global or local and regional impacts. As air pollution has an important impact on human health, the issue of air quality is given great importance all over the world. To address air pollution problems and identify strategies, both the scientific community and the relevant authorities focused on monitoring and analyzing atmospheric pollutant concentrations (Kyrkilis et al., 2007). Since the authorities are responsible for maintaining and improving air quality, as well as having a direct impact on public health, they are also responsible for providing the public with up-to-date information on air pollution through communication tools. However, understanding the measurements of different contaminants is difficult for the general public and local authorities, even if it is possible for a scientist working on this issue. For this reason, a classification system is used which the public can easily understand while explaining the state of air pollution/air quality to the public. This classification system, commonly used around the world, is called the air quality index (AQI), and according to the concentrations of pollutants in the air, the quality ratings are made in the forms of good, medium, bad, dangerous, etc. Methods and criteria used in index calculation in many countries of the world have been established in accordance with the air quality standards applied in their countries.

The success of a nation in improving air quality depends on the support of properly and well-informed citizens on local and national air pollution problems and developments in pollution reduction (Sharma et al., 2003). Developing a suitable tool for understanding pollutant levels in a region is of great importance. This tool provides accurate and understandable information about the level of air pollution of the citizen, and should also be used by relevant authorities to take measures to protect public health (Kyrkilis et al., 2007). For this purpose, the standard values developed can be presented by translating them into an index widely in terms of both stimulation and comprehensive and usage. This index is called the Air Quality Index/AQI (Air Quality Index / AQI), in which the countries convert according to their own limit values to characterize air quality in a particular region and where pollution classification is made. The index is expressed in different definitions and colors in specific categories and arranged separately for each pollutant to be measured (Yavuz, 2010).

³¹ Aydın Province, Environmental Assessment Report of 2015

The National Air Quality Index was created by adapting the EPA Air Quality Index to our national legislation and limit values. Air Quality Index is calculated for 5 basic pollutants. These include particulate matter (PM10), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂) and ozone (O₃).



Figure 111 Air quality measurement station of Aydın province

Air pollution reduces the quality of life of people as it affects human health directly or indirectly. Today, local, regional and global problems are widespread due to air pollution.

Due to heavy urbanization, wrong settlement of cities, increased number of motor vehicles, irregular industrialization, poor fuel use, topographic and meteorological conditions, air pollution can be experienced especially in our large cities during the winter season.

Measuring air quality in an area is of great importance in terms of knowing what kind of air inhaled by people living in that area. In addition, an important point is that air pollution occurring in a region is not only seen in that region but also caused global problems (global warming, acid rains, etc.).

Sulfur dioxide (SO₂), a colourless gas, is oxidized as sulphate and sulfuric acid after reaching the atmosphere. Together with other contaminants, it creates droplets or solid particles that can be carried over large distances. SO₂ and oxidation products are removed from the atmosphere by means of dry and humid deposits (acid rain).

Nitrogen oxides (NO_x), nitrogen monoxide (NO) and nitrogen dioxide (NO₂) form the total nitrogen oxides (NO_x). Nitrogen oxides are usually given out as NO (in 90% of the cases). It occurs as a result of the reaction of NO or NO₂ with ozone or radicals (such as OH or HO₂). NO₂ is one of the most important air pollutants in urban areas since it is the type of nitrogen oxide that affects human health most. Nitrous oxide (NO_x) emissions are made from human sources. The main sources are vehicles in land, air and sea traffic and combustion boilers in industrial plants.

In terms of human health effects, exposure of healthy people to very high NO₂ concentrations for a short time can lead to severe lung damages. For the individuals having chronic lung diseases, the exposure to this derivatives can cause dysfunctions in the lungs in the short term. In case of prolonged exposure to NO₂ concentrations, it is observed that respiratory diseases have increased substantially.

Dust Particle Matter (PM₁₀), the term particle matter refers to solid particles in the air. These particles do not have a single type of chemical composition. Solid particles are directly involved in the atmosphere, as a result of human activity and from natural sources. They react with other contaminants in the atmosphere and form PM and are given to the atmosphere. (the PM₁₀ - has an aerodynamic diameter below 10 µm) The works on legislative regulations to cover particles up to 2.5 µm are under process. The biggest natural source for the PM₁₀ is dust from the roads. Other important sources are traffic, coal and mine quarries, construction areas and quarries. In terms of health effects, the PM₁₀ may accumulate in the respiratory system and cause various health effects. It can worsen respiratory ailments such as asthma, leading to various serious health effects including premature death. People with heart or lung disease, such as asthma, chronic obstructive pulmonary disease, or heart disease, may have a worsening of their health condition when exposed to PM₁₀. Elderly people and children are sensitive to PM₁₀ exposure. With the help of PM₁₀, other pollutants present in the dust can go down to the bottom of the lungs. Most of the thinner particles can reach the alveoli in the lungs. From here, toxic substances like lead can pass into the blood as 100%.

Carbon monoxide (CO) is an odorless and discolored gas. It emerges as a result of the carbon in the structure of the fuel not to be combusted completely. CO concentrations typically reach the highest value in cold seasons. One reason for achieving very high values in cold seasons is inversion. CO's global background concentration is between 0.06 and 0.17 mg/m³. In the EU directive 2000/69/EC, the limit values related to CO have been determined.

The inversion is a condition in which hot air is placed above cold air and prevents the air from mingling vertically with each other. Pollution is thus collected in the cold air layer near the ground level.

The main source of CO is congestion in traffic and the traffic itself. Health effects are chemically linked to hemoglobin by entering the bloodstream through the lungs. This substance in the blood, carries oxygen to cells. In this way, CO decreases the amount of oxygen reaching the organs and tissues. In healthy people, exposure to higher levels of CO can affect the perception and the vision power of the eye. People with mild and more severe heart and respiratory diseases and newborn babies are the most risky group against co-contamination.

Lead (Pb) is not found in nature as metal. Lead is a good protector against noise, radiation and vibrations and is carried by air. Lead is spreaded to the environment due to the mines, process of copper and bronze (Cu+Sn) alloy, recycling of lead-containing products and burning of lead oil. The use of lead-containing gasoline supplements also increases the lead ratio in the atmosphere.

Ozone (O₃) is an odourless colorless gas consisting of 3 oxygen atoms. Ozone pollution occurs especially in sunny weather and high temperature during summer (NO₂+ sun beams = NO+ O => O+ O₂ = O₃). Ozone production is accelerated or strengthened by means of volatile organic compounds (VOC) and carbon monoxide. The most important pioneering compounds for the formation of ozone are NO_x (nitrogen oxides) and VOC. Due to the high solar radiation, ozone concentration is higher in Mediterranean countries than in North-European countries. The reason is because of the function of solar radiation in the photochemical formation of ozone.

Compared to other pollutants, ozone is not directly involved in ambient air. Ozone is formed by complex chemical reactions at a level close to the ground. These reactions are added in chemical substances such as NOX, methane, CO and VOCs (ethane (C₂H₆), ethylene (C₂H₄), propan (C₃H₈), benzene (C₆H₆), toluene (C₆H₅), XYLEN (C₆H₄). Ozone is a very powerful oxidation agent. It interacts with many biological substances and may cause harm to the respiratory system. The harmful effect of ozone depends on concentration and duration of exposure to ozone. Children form a large group of risk. Other groups include people who have physical activity outside at noon, asthma patients, lung patients, and elderly.

Air quality monitoring station is located in the center of Aydın and provides high amount of data. However, due to the location of the station on the Izmir-Denizli highway border and the layout adjacent to the vehicle transition route, the PM₁₀ measurement results are thought to be high. In addition, since the establishment of the measurement station, there has been an increase in the number of residential areas and housing in the city center, it is assumed that the data received from one station are not the values representing the centre of the Province. For this reason, measurements should be made through a second station to be placed at a different point in the center and the values obtained from the stations should be compared and objective and healthy results representing the centre should be obtained. In addition, taking into consideration that the transition to natural gas is realized rapidly in Aydın province, necessary investment and work should be done in station type and measurement parameters.

Regarding the fight against air pollution in Aydın province, our Provincial Directorate works in coordination with the Metropolitan Municipality, Provincial Police Directorate, Provincial Gendarmerie Command. During the winter season, inspections are carried out in combustion systems by the teams to be created by the Metropolitan Municipality and Provincial Directorate of Inspection personnel on fuels to be used in combustion systems, firemen are inspected and hand-leaflets prepared with information on appropriate combustion techniques are distributed.

In addition, with the decision of the Local Environmental Board dated 01.12.2014 and numbered 179, the public institutions and organizations, houses, schools, hospitals, student dormitories, apartments, hotels and motels with thermal power over 300 kW, the chimney gas emissions are determined by the regulation on the control of air pollution caused to attract the limit values determined by the Directive on the Control of Air Pollution from Heating, the building owner or managers who are obliged to filter the filter systems approved by the Chamber of Mechanical Engineers and/or the Environmental Engineering Department, between the combustion plant and chimney with reference to the boiler maximum capacity, until the beginning of the 2015-2016 winter season, additional decisions have been taken and efforts have been initiated to implement the decision of the Board of Directors regarding the establishment and operation of the filter systems and to report these decisions to the relevant Metropolitan Municipality presidency.

Again, when examining the data of air quality measurement station, the fact that the SO₂ value is low despite the high PM₁₀ value in Aydın province strengthens the assumption that there is no problem in the quality of coal used in Aydın province. The fuel audits conducted in recent years were also indicated no illegal and unsuitable coal usage. However, since high PM₁₀ values, especially observed during the first burning hours of the central heaters, are considered to have an important role in burning systems and burning devices among all other factors, our controls in this direction have been increased in winter season by our Provincial Directorate and cooperation with the Public Training Centre for the training of the burners.

Noise³²

There is no noise pollution in Aydın Province due to the fact that industrial facilities are usually located far away from the settlements. In addition, the EIA reports prepared in accordance with the Environmental Impact Assessment (EIA) regulation issued in accordance with the Environmental Law No. 2872 for the enterprises to be established provides the necessary measures to prevent noise pollution.

To reflect this, noise complaints sent to the Provincial Directorate of Environment and Urbanisation are evaluated and procedures are followed in accordance with the relevant regulations. In residential areas, vehicles and equipment used during building and road work can cause high levels of noise and long-term operation of these machines can disturb the mental health of workers and the people around them and the peace of society. Short and long-term operations, sudden and continuous, but high-level noise, especially in the nearby environment is uncomfortable during the summer months.

Parks, gardens, forest areas and the cemeteries are known as the quietest areas of the cities in international standards and in the standards of developed countries. The calmness of these areas depends on the peace of the community, the availability of transport and industry noise, or the technical measures taken against such noise. In such quiet areas where people need rest, noise pollution is caused by some recreational enthusiasts who are insensitive to the environment and do not respect other people.

In addition, in recent years, outdoor entertainment places have been increasing, all night long until the early hours of the morning, environmental noise assessment and management regulations contrary to the standards and electronic amplified music sounds and nearby housing and recreation facilities can create a great disturbance. High electronic sounds can be extended to much longer distances during nights when transportation noise and other background noise are minimized.

Environmental Noise Assessment and Management Directive published in the Official Gazette dated 04.06.2010 and numbered 27601 has been amended with the regulation published in the Official Gazette dated 27.04.2011 and numbered 27917. With the amendment of the Directive “very sensitive uses” “health institutions with beds, educational periods boarding education institutions, children and elderly care houses”, “sensitive uses” housing, bed service facilities, educational institutions, open land and residential area such as quiet areas, less sensitive uses administrative and commercial buildings, children Gardens, areas of playgrounds and sports facilities such as very sensitive areas and very sensitive areas of use are defined as areas that are determined to include 250 meters from the limits of very sensitive areas.

³² Aydın Province, Environmental Assessment Report of 2013

With the amendment of the Directive, live music broadcasting in open and semi-open entertainment areas in very sensitive areas is prohibited. In these areas, the establishment of outdoor and semi-outdoor entertainment places will not be allowed. Open and semi-open entertainment spaces in these areas will be closed until 31.12.2011. Environmental noise caused by environmental noise caused by recreational areas and recreational areas adjacent to the environment should not exceed the background noise level in the affected building as a Leq noise indicator. Environmental noise caused by by recreational areas and non-residential entertainment areas should not exceed the background noise level of the Leq noise indicator no more than 5 dBA and 7 dBC. The total noise level emitted from multiple entertainment venues should not exceed the background noise level in the Leq noise indicator above the range of 7-10 dBA. It is forbidden to broadcast live music between 24.00-07.00 at open and semi-open entertainment places in areas of sensitive use.

In addition, in areas near, adjacent, below or above which may affect very sensitive uses with this Directive, the realization of outdoor activities such as concerts, demonstrations, rallies, ceremonies, festivals, weddings and so on are prohibited. The noise level emitted from such activities in areas with sensitive and less sensitive uses shall be carried out in such a way that the current background noise level shall not exceed 5 dBA.

Water Pollution³³

The reasons for the pollution in the Greater Menderes River are listed below:

Dokuzsele River (Uşak), Banaz Brook (Uşak), Çürküsu Brook (Denizli), Greater Menderes Plain (Aydın), Bafa Lake (Aydın) are hot spots where pollution is intense. In comparison with the point pollution loads from urban areas, industrial facilities and regular storage facilities in the basin, the point pollution has a smaller share of total pollution. The textile and leather industry which are the industrial pollution-causing sectors are concentrated in Denizli and Uşak. In the Greater Menderes River, which reaches Aydın province with the effect of the pollution sources in the upper basin and entering the borders of the District of Buharkent, the DSI 21st Regional Directorate monitored and tated the most serious problems seen in terms of water quality;

- Excessive organic matter, nitrogen, pH, heavy metal pollution and oxygen deficiency from Gökpınar Brook coming from Denizli;

- With the salinity problem added to organic matter and nitrogen pollution that continues in Denizli-Sarayköy-Kuyucak line in Çürküsu Brook and Greater Menderes River

- Excessive organic matter and nitrogen pollution caused by Uşak (before Banaz Brook) at Dokuzsele brook with salinity and oxygen deficiency.

³³ Aydın Province, Environmental Assessment Report of 2015

The river enters into Aydın Province borders with inorganic pollutants at 3rd class, organic pollutants at 4th class (very dirty water-agricultural irrigation can not be used) in terms of the water quality. The river has improved on the basis of inorganic and organic parameters starting from the township of Kuyucak, and reaches to IInd level water quality on the basis of organic parameters. (It is observed that the pollution load is diluted due to the side stream connected to the river and brooks.) However, in terms of the sulphate parameter, it maintains the IVth class characteristics. There are many brooks and watercourses which have joined the Greater Menderes within the borders of Aydın Province. These are the Feslek, Kestel, Malgaç, Köşk, Musluca, İmamköy, Tabakhane, Karagöz, Yalkı, İkizdere, Alangüllü, Kocadere, Dalama, Çakırbeyli, Çakmar, Koçarlı, Sarıçay Watercourses, Çine, Akçay and Dandalaz Brooks. When the pollution of the Greater Menderes River is classified in Aydın province;

-Pollution Resourcing from Industrial Facilities;

The leather, textile, cotton weaving, yarn and ceramic sectors operating in Uşak province is discharged the waste waters to Dokuzsele Brook that is one of the branches of Banaz brook feeding the Adıgüzel Dam.

Similarly, the wastewater of many textile-intensive establishments operating in Denizli province is also discharged to Çürüksu Brook and the Greater Menderes River via the other side branches of the Greater Menderes River. There are many industrial facilities in Denizli. However, it is necessary to constantly check whether these treatment plants have been operated in accordance with the appropriate standards. In addition, almost all of these treatments have been constructed according to the discharge criteria determined by sectors. Since Çürüksu Brook and the Greater Menderes River in which these wastes are discharged are used for irrigation, the minimum irrigation water discharge criteria must be met. Therefore, these wastewater treatment plants need to be renewed in order to meet the minimum irrigation water discharge criteria. The treatment plant of Menderes Textile Factory, which is also located near Sarayköy, should be periodically inspected whether the treatment plant has been operated continuously. Because the waste of this factory is emptied directly into the Greater Menderes River.

Other small industrial facilities operating in the provinces of the basin do not have treatment facilities or are not operated efficiently. The situation of industrial facilities affecting the pollution of the Greater Menderes River after entering the borders of Aydın province is summarized below.

In Aydın province, especially in the years when olives are produced, the red water stemming from olive oil factories is also a polluting factor. The waste water, known as red water, which was extracted during the processing of olives in approximately 154 olive oil factories in Aydın province, contains 5,19 ppm boron mineralae and has high values of Chemical Oxygen Demand (COD). Although these enterprises operate seasonally, the pollution they have created in the region is not negligible because of the fact that the large numbers, high amounts of waste water, the chemical content of the red water and the lack of treatment technology of these facilities. Due to the fact that olive oil factories are established in almost all the sub-provinces, a common treatment plant cannot be constructed for these plants, and since they are small enterprises and the treatment cost of the red water is high and it cannot be treated completely with present technologies.

In order to solve the olive red water problem, the waste water disposal of olive oil factories in Aydın province, the former Ministry of Environment and Forestry, in accordance with the opinions of the EPSP General Directorate dated 12.7.2002 and numbered 10691, in accordance with the decisions taken by the local environmental council of Aydın dated 29.3.1996 and dated 09.4.1997, all waste water (red water) that can be collected in a season in open-seal vaporization lagoons (pools) is collected and disposed of evaporation, and no waste water will be discharged to any receiving environment apart from these pools were applied.

One of the main sources of water pollution in Aydın province is olive oil processing plants. The black waste water (red water) which emerged as byproduct during the processing of olives in these plants, requires a difficult and expensive waste water treatment due to its high amounts of chemical oxygen content. In Aydın province, there are 154 olive oil factories spread all over the province. After the disposal of olive oil factories (territorial waters) by the General Directorate of Environmental Management of Ministry of Environment and Forestry, by building non-leak proof vaporization lagoons (pools) at the capacity where the waste of olive oil factories (territorial waters) can be temporarily collected in at least one season, the other methods mentioned in the article (transition to the 2-phase system) to ensure the disposal of the appropriate one by selecting and stating that it should not be given to the receiving environment in any other way, by our Provincial Directorate, in accordance with the instructions in question is being carried out. In the case of evaporation and disposal of olive black water from olive oil plants in the lagoon (concrete, PVC or membrane coating method, clay laying method, etc.), the effect on underground waters, capacity adequacy and the amount of precipitation due to seasonal conditions should be taken into consideration. However, the large number of facilities and the dispersed situation makes it difficult to control, most of them are located in rugged terrain because of the proper and sufficient size of lagoons, lagoons filled with excessive rainfall, such as the applicability of this method is experiencing difficulties.

There are 6 Organised Industrial Zones (OIZ) to be constructed currently or in the future as the industrial pollution sources in Aydın province. As a result of the increase in water use and changes in wastewater character in Aydın OIZ operating in Umurlu Municipality, a new contract for the preparation of the project has been signed with the decision of establishment of industrial type AAT with a capacity of 2500 m³/day, and the procedures related to the public interest decision regarding the plant area are continuing.

Currently, some of OIZ wastewater is purified and some of it is discharged directly into Musluca brook. In the concerned industrial zone, there is a waste water treatment plant that is inadequate in quantity and quality, and it is still in operation to reduce the pollution burden of the waste water. The wastes of the OIZ in question reached to the Greater Menderes River through Musluca brook.

Industrial (physical+biological+chemical) type AAT of 1700 m³/day capacity belonging to ASTIM OIZ was completed and commissioned in December 2011. GFB application has been made for the discharge of the waste water from the facility into the receiving environment and its operations are continuing.

Construction of industrial (physical+biological+chemical) type construction of 2000 m³/day capacity of the Ortaklar OIZ directorate is being constructed.

The waste water formed in Nazilli OIZ at the installation phase is given to the AAT of Nazilli Municipality in accordance with the protocol and assembly decision made between Nazilli Municipality and OIZ management.

Expropriation and infrastructure investments in Çine and Söke organised industrial zones are under the process, the AAT construction project preparation works (according to the facilities to be established) are continued.

- Domestic Waste Water Pollution

The waste waters are discharged to the Greater Menderes Water directly or indirectly along with the basin because most of the existing residential areas do not have wastewater treatment plants, so it has a negative effect on the pollution of the river.

- Chemical Fertilizers and Pills used in Irrigated Farming

Chemical fertilizers and drugs which are used in the areas where irrigated agriculture is carried out are transferred to the water by mixing into the surface waters or by leaking into the depths. Some of these waste-contaminated underground waters are discharged into the surface waters through drainage and consequently the quality of the surface waters is reduced. In the same way, it is possible to mix these waters into underground waters and create pollution.

Impact of Planned Project on Current Pollution Load

Determination of the Pollution Load for the Air

The project area is located near the highway and some facilities. Sources that may affect the project site and its immediate environment in terms of air pollution are emissions from domestic heating and transportation in the region. However, due to the fact that the project area is in the Aegean region and the winters are not too harsh, it is difficult to talk about the emission caused by domestic heating. The vehicles of various sizes pass from the nearest part of the Izmir-Aydın highway to the field of activity, and emissions from these vehicles appear as important pollutants for agricultural products especially on roadside.

The amount of seasonal pollutants from fossil fuels varies depending on the quality and quantity of burned fuel. In the region where quality coal is used as default, the pollution from domestic heating is negligible.

Geothermal fluids include heavy metals and chemicals, as well as gases that do not condense in different amounts. Since the gas in question exists under a certain pressure in the reservoir, they are dissolved in the geothermal fluid. Condensation of the gas content released during the operational phase of geothermal power plant can be listed as CO₂, N₂, CH₄, NH₃, H₂S, O₂ and H₂. In volume, there are about 99% CO₂ trace amounts of other gases.

The project aims to generate much lower CO₂ emissions compared to the power plants that generate electricity using fossil fuels. It is observed that emissions are less than those used in coal and natural gas plants.

During the operation period, the provisions of the legislation will be strictly complied with and, if required and/or requested, emission measurement shall be made to the competent authority to carry out measurements and shall be submitted to the relevant authority.

In the context of the planned project, all measures related to emissions will be taken in the construction and operation phase.

In all phases of the project, "Directive on the Control Air Pollution Resulting from Industries (SKHKKY)" which came into effect after being published in the Official Gazette dated 03.07.2009 and numbered 27277 and the amendments to be made in the Directive;

RG-30.03.2010-27537

RG-10.10.2011-28080

RG-13.04.2012-28263

RG-16.06.2012-28325

RG-10.11.2012-28463

RG-20.12.2014-29211 defined the requirements.

Cumulative H₂S Modelling to be Performed within the Scope of the Project

During the operation phase of the plant, there is the release of greenhouse gases such as non-condensing carbon dioxide and methane in geothermal resources. Geothermal fluids include heavy metals and chemicals, as well as volatile gases, depending on reservoir conditions. These gases are dissolved in the geothermal fluid because they are located under a certain pressure in the reservoir. Geothermal power plant during the operational phase of the geothermal fluid into electrical energy to be converted in Phase pressure and temperature of the fluid, pressure and temperature for condensation of the gas released losing content; CO₂, N₂, CH₄, H₂S, H₂, O₂, Ar, C₂H₆ and C₃H₈ by volume and about 99%, trace amounts of other gases as compared to CO₂ occupies a significant place.

The planned project is expected to generate emissions from the cooling tower only at the operating stage like all the geothermal power plants currently operated and planned at the license site. The amount of geothermal fluid use of the plants within the project and the amount of non-condensing gas in the project area is given in Table 75.³⁴ In order to compare these emissions with the "Directive on Control of Industrial Air Pollution" limit values, the values of the mass flow rate need to be calculated. The average Mol percentage of the gases in the geothermal fluid is calculated and the average Mol percentage is presented in table 76.

Table 75. Geothermal fluid use of power plants and non-condensing gas quantities in these uses

Facilities	Fluid Flow (Ton/hous)	Noncondensable Gas Amount
Efe 1	2.25	29,7
Efe 2	1.10	14,5
Efe 3	1.10	14,5
Efe 4	1.10	14,5
Efe 6	1.40	18,4
Efe 7	1.50	19,8
Efe 8	2.50	33
Galiphoca	2.25	29,7

Table 76. Molar percentage of gases in 1 mole at the outlet of the cooling tower

	CO ₂	N ₂	CH ₄	H ₂ S	H ₂	O ₂	Ar	C ₂ H ₆	C ₃ H ₈
Molar %	0.9927500	0.0037590	0.0028600	0.0004490	0.0000580	0.0000420	0.0000300	0.0000260	0.0000060

Accordingly, the gas emmissions to be expected from the cooling towers are calculated as below.

³⁴ As a result of the analysis and evaluations made, approximately 1.32% of the geothermal resource is composed of non-condensing gases.

Weight of 1 Molar gas;

$0,9927500 \times 44 \text{ g/mol (CO}_2\text{)} + 0,003759 \times 28 \text{ g/mol (N}_2\text{)} + 0,00286 \times 16 \text{ g/mol (CH}_4\text{)} + 0,000449 \times 34 \text{ g/mol (H}_2\text{S)} + 0,000058 \times 2 \text{ g/mol (H}_2\text{)} + 0,000042 \times 32 \text{ g/mol (O}_2\text{)} + 0,00003 \times 39,9 \text{ g/mol (Ar)} + 0,000026 \times 30 \text{ g/mol (H}_2\text{)} + 0,000006 \times 44 \text{ g/mol (H}_2\text{)} = -43,85 \text{ g/mol}$

Thus, the emission amounts for H₂S to be calculated;

$\text{H}_2\text{S} = \text{Non-Condensed Gaz Amount} \times 8.760 \text{ sa/year} \times 0,000449 \times 34 \text{ g/mol} / 43,85 \text{ g/mol}$. Accordingly, the H₂S emission amount of each facility is given Table 77.

Table 77. H₂S emissions of each plant

Facilities	Emission Amount (ton/year)
Efe 1	90,5
Efe 2	44,2
Efe 3	44,2
Efe 4	44,2
Efe 6	56,3
Efe 7	60,3
Efe 8	100,
Galiphoca	90,5

Calculation of the Contribution to the Air Pollution

AERMOD (AMS/EPA Regulatory Model Improvement Committee Model), which was developed by the EPA as an air distribution model and approved by the same organization for use in EIA studies in the USA, was used. The AEROMADERMOD model is internationally accepted, and is used by many researchers around the world to estimate polluting concentrations by inspection and authorization bodies. The basis of the model is the Gaussian distribution. With this model, many emission sources (point, area, line and volume) can be modeled at the same time or separately.

The modeling performed in the region with hourly and 24-hour (daily) average pollutant YSK values have been determined and these values were compared with the short term and long term limit values in the SKHKKY. As a result of these comparisons, effects of dust emissions on air quality in the region were determined.

The model results were compared with the values given for H₂S in Annex-2 Table 2.2 (SKHKKY) of the Directive on the Amendment of the "Directive on the Control of Industrial Air Pollution" which came into effect after being published in the Official Gazette dated 20.12.2014 and numbered 29211.

Three kinds of data set were employed to operate the AERMOD model. There are give below;

- Topographic data (DEM file to be generated by the help of AERMAP)
- Meteorological data (Profile and Surface files to be generated by the help of AERMET)
- Emission Data

Emission Data to be Employed in Modelling

The model was operated by considering the worst case scenario, as stated in SKHKKY Annex-2.4, there is no decrease in the concentrations of pollutants due to wet or dry sediments and that the pollutants are emitted without radioactive degradation and without conversion to sub-products.

During the operation of the model, the emission data from cooling towers were used in the operation phase of the project.

Topographic Data to be Employed in Modelling

In modeling studies, considering the plant chimneys, an area to be more than fifty times of the height of the highest chimney, 8 x 8 km zone was selected as a field of study.

By means of the AERMAP software, which is the preliminary processor of the AERMOD Model, 500 m reference points specified in SKHKKY for the modeling area have been created and the data file of the modeling area has been created. Thus, a physical relationship between the properties of the land and the distribution of air pollution is provided. As a result, AERMAP generates elevation data for each grid point. In addition, the distribution model provides data to continue distribution around the upgrades or to maintain the effects of the air flowing through the compartment.

In the AERMOD through the DEM file to be generated by the help of AERMAP in order to determine the effects of the units planned to be installed on the existing air quality, a grid system was created within the scope of the survey and the edge lengths of the squares were formed in this system to be 500 m. The corner points of the squares in the grid system are defined as receiving environments and topographic elevations at these points are determined by the help of the Dem file. The study area was digitized by this method and used as model input.

Meteorological Data to be Employed in Modelling

Meteorology is the most important factor affecting atmospheric distribution of pollutants. Data obtained from the General Directorate of Meteorology was used for the provision of meteorological information required for modeling studies.

Main level drilling data is required to create the profile file required for AERMET. Main level drilling data are made in 8 provinces (Ankara, Istanbul, Izmir, Isparta, Samsun, Adana, Erzurum and Diyarbakır) in Turkey, and main level drilling data belonging to Izmir Meteorological Station and meteorological data belonging to Aydın province are provided for use in modeling.

The AERMOD model accepts wind speed and direction, temperature, stability class, main level drilling data at hourly basis. For this reason, some regulations must be made in order for the data to be used in the model. At this stage, meteorological files to be entered into the model were created using the preliminary processor AERMET program which organizes the weather data in a way that can be used in aerod.

During the operational phase of the project, which will be given to the atmosphere from the cooling tower and the Directive on Control of Industrial Air Pollution limit values given in Table 2.2 from the contaminant hydrogen sulfide (H₂S) gas and cumulative impact assessment studies in the context of the current situation in the enterprise Efe 1-2-3-4, Galiphoca GES, ongoing construction Efe-6 with planned Efe-7 and Efe-8 the working status of the project by evaluating the model study was conducted. Physical information about cooling reservoirs, which are the emission sources of plants is given in Table 78.

Table 78. Physical information about plant flues

FACILITIES	Cooling	Numb	Height (m)	Diameter	Satck Gas (m/s)
Efe 1	Water Cooling	8	15,8	9.144	7,2
Efe 2	Air Cooling	8	12	4.910	3,5
Efe 3	Air Cooling	8	12	4.910	3,5
Efe 4	Air Cooling	8	12	4.910	3,5
Efe 6	Air Cooling	5	12	8.250	4,4
Efe 7	Air Cooling	5	12	8.250	4,8
Efe 8	Air Cooling	10	12	8.250	8,0
Galiphoca	Water Cooling	8	15,8	9.144	7,2

Limit values for hydrogen sulfide gas and cumulative data obtained from all plants in the region (Efe 1-2-3-4-6-8, Galiphoca) are given in the table as a result of AEROD modelling work.

Table 79. Limits for the maximum hourly level, short-term level and RIAPC obtained by modeling for H₂S emissions likely to occur during the operation phase

EMISSION	AVERAGE PERIOD	Hourly Value	Short Term	RIAPC Table 2.2. LIMIT VALUES (KVS and UVS)
H ₂ S	Saatlik	0,00001	-	100 µg/m ³
	KVS	-	0,000001	20 µg/m ³

As shown in Table 79, the maximum hourly value and KVD values obtained by modeling studies for H₂S emissions that are likely to occur from all plants during the operation phase provide the limit values (hourly and KVS) specified in Table 2.2.

When we look at the Air Quality Effect Values to be obtained using the AERMOD model, it is estimated that the possible emissions from the project's operation phase will provide SKHKKY limit values and therefore the operation will not pose any danger to human and environmental health. In the modeling study, it is assumed that all power plants are in operation and emission distribution within the framework of the current technologies, and the processes where H₂S treatment efficiency is higher with developing technologies are preferred and the amount of emissions is expected to decrease. The map showing the results and distribution of the model work performed is presented in the following ways.

BREEZE AERMOD Model Results													
Highest Results of Pollutant: H2S													
Avg. Per.	Grp ID	High	Type	Val	Units	Date	UTM		Elev. (m)	Hill Ht. (m)	Flag Ht. (m)	Rec. Type	Grid ID
						YYMMDDHH	East (m)	North (m)					
1-HR	ALL	1ST	Avg. Conc.	0.00001	ug/m ³	11082110	556535.75	4191092.84	44.00	481.00	0.00	GP	7QKHF000
24-HR	ALL	1ST	Avg. Conc.	0.00000	ug/m ³	11092524	556535.75	4191092.84	44.00	481.00	0.00	GP	7QKHF000
Summary of Total Messages													
#	Message Type												
0	Fatal Error Message(s)												
2	Warning Message(s)												
804	Informational Message(s)												
8760	Hours Were Processed												
146	Calm Hours Identified												
658	Missing Hours Identified (7.51 Percent)												
Error & Warning Messages													
Msg. Type	Pathway	Ref. #	Description										
WARNING	OU	W565	Possible Conflict With Dynamically Allocated FUNIT PLOTFILE										
WARNING	OU	W565	Possible Conflict With Dynamically Allocated FUNIT PLOTFILE										
www.breeze-software.com													

Figure 112 Aermod model result

The distribution of the modelling work within the license area is given in the following way.

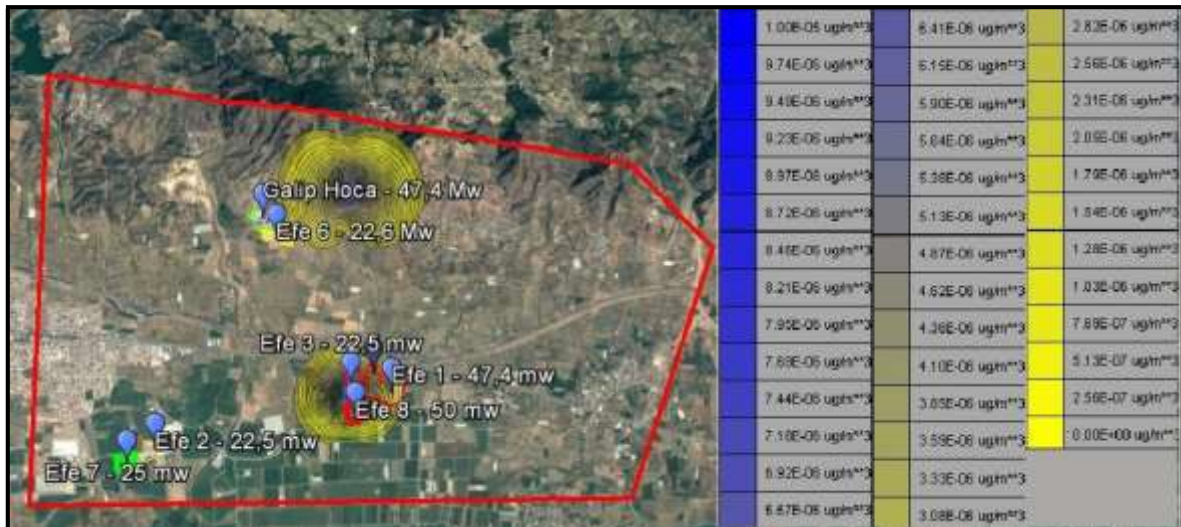


Figure 113 Cumulative modeling distribution within Licence J-553 Area

In AERMOD modeling studies, topographic data (DEM file to be created by the help of AERMAP) and meteorological data (Profile and Surface files to be created by the help of AERMAT) were used together with the emission data of plants.

The dominant wind direction E (east), secondary wind direction ESE (East-Southeast), third-degree wind direction W (west) according to the number of blowing for many years between 1960 and 2015. According to the observation records, the maximum wind direction observed is 28 M/s at WSW (West-Southwest). Dominant wind direction, blowing numbers and other meteorological characteristics are given under "II.2.1 Meteorological and Climatic Features".

The data used in modeling studies are based on the hourly model distribution figures in Figure 114 and 115. Such distribution data is obtained by reflecting the numerical values in the calculations on the data and show the areas where the concentration values are more intense.



Figure 114 Modeling distribution (south)



Figure 115 Modeling distribution (north)

Determination of the Pollution Load for the Water

The most important and prominent causes of pollution of natural waters are unconscious use of fertilizers, domestic waste directly to the soil and urban and industrial waste and waste water to be given to the environment without treatment. After solid, liquid or gas wastes are given to the environment, pollution can occur as a result of transfer to underground water depending on climate conditions, soil structure and time.

In underground waters, it is possible to say that nitrogen and phosphorus-weighted pollutants are more concentrated. This shows that underground water is negatively affected due to fertilizers used in agricultural activities in the region.

At all stages of the activity, domestic quality waste water will be collected in the non-sealed cesspool and no discharge will be made to any receiving environment and will not affect the existing pollution load.

The test waters that will emerge in the drilling works will be transferred to the geomembran material and will not have any effect on the existing pollution load, as no discharge will be made to any receiver environment.

Determination of the Pollution Load for the Soil

The project area and the soil structure around it are very favorable, productive soils for agriculture. The project will be carried out with the aim of generating electricity through renewable energy source, and there will be no change in soil quality as waste and/or discharges will not be given to soil and rivers without the limit values specified in the regulations.

On the other hand, in the construction and operation phases, the provisions of the Directive on Control of Soil Pollution and Spotless Areas, which came into force after being published in the Official Gazette dated 08.06.2010 and numbered 27605, will be complied with.

Determinaiton of Current Load for Noise

Air quality measurements and noise measurements are carried out by the investing company to determine the current situation. The measurements and analysis of samples taken within the scope of the J-553 licence area have been carried out by accredited laboratories and no noise has occurred above the limit values specified in the legislation.

III.2.23. Impacts of the activity on biodiversity and ecosystem, and measures to be taken

In the operation stage, the negative impact that may occur on flora and fauna, especially the drinking water of fauna species, feed source access, shelter, breeding areas will not be intervened and as the hunting limitations and bans are followed, the vital activities of flora and fauna will be prevented at flora and fauna.

Because there is no commercial concern about the activity, there will be no effect on species mentioned in the fauna lists and other species protected by international conventions, such as hunting, deliberate killing or taking, harming their eggs.

In addition to the measures that can be taken, in case of the determination of any kind of species in the fauna under the protection as a sensitive and vulnerable species in the field of the project, the relevant regulations will be complied with, and the Land Hunting Law and the Directive No. 4915 (on Hunting Ban) and the international conventions (BENN and CITES Convention) will be adhered to protect the species.

Within the scope of the Efe-7 Geothermal Power Plant Project, which is planned to be realized, an academician from Ankara University, Faculty of Agriculture, namely Assoc. Dr. Mücahit Taha Özkaya prepared a report on "Determination of the Effects of Olive Trees around Geothermal Power Plant Project on Vegetative and Generative Development", and it is presented in Annex-24.

The above-mentioned report states that "as a result, existing geothermal wells, geothermal drilling for geothermal fluids and gases from power plants caused no observation with a damage on olive and fig trees. It is considered that the geothermal power plants that will be built will have no damage during the operation phase on figs and olive trees in the region".

The determination in said report under the heading of "the matters to be considered by the business with reference to the olive production" will be complied.

III.2.24. Other Characteristics

There is no any other matter to be stated under this heading.

III.3. Project Impacts on the socio-economic setting, and measures to be taken

III.3.1. Revenue increase, employment growth, population movements, and migration expected to be realized with the project, educational, healthcare, cultural and other social and technical infrastructural services (agriculture, livestock, tourism, greenhouse cultivation, etc.) and the availability of these services

In parallel with the growing industry and economic development of our country, a rapidly increasing demand for energy is emerging. It is obvious that the economic investments in the production capacity of our country will serve the interests of domestic investors and our people.

Our country's energy policy is to provide all its users with reliable, good quality and clean energy at the right time in order to support economic and social development. For this purpose, all domestic and imported energy sources are expected to be used and all domestic - foreign, private-public investment and financial opportunities are expected to be used to provide the energy needed to meet the energy demands economically and reliably.

The electrical energy to be produced within the scope of the project will play an important role in meeting the increasing electricity demand of Turkey.

It can be said that the materials needed within the scope of the project will be provided from the facilities in the region; the fuel and mineral oil requirement required for construction machinery and vehicles and the personnel to be employed will be provided from the region in terms of technical, social and economic needs, so the economic activities in the region will expand.

The piping plan to be made within the scope of the project will be realized in such a way that it does not interfere with roads, field crossing and animal crossing. Piping works will be carried out at the road border of the parcels in the region. So there will be no unnecessary land use for pipes. In this way, the effects will be reduced to the surrounding agricultural areas.

Income Growth

While agriculture is primarily the source of economics of the people living in rural settlements in the vicinity of the area where the power plant will be built, it provides employment for the people living in neighboring settlements in industrial zones in the region.

In the construction and operation phases of the Efe-7 geothermal power plant, total of 258 personnel are planned to be employed. A large part of the unskilled workers who are planned to be employed with the project will be taken from neighboring settlements.

It is estimated that all stages of the investment and throughout the production period all the necessary needs will be met from the region to provide employment opportunities to the inhabitants of the region and to increase the living standards of the personnel provided by the employment.

Employment

Realization of the project will stimulate the economy in the region. Considering that Efe-7 GPP will provide job opportunities for 250 in the construction phase and 8 people during the operation, that the need for unskilled labor will be met from the region, problems such as unemployment will be reduced in the region. It is clear that providing employment to the residents of the region as much as possible will have a positive impact for the employment in the region. In addition, the creation of new job opportunities will stimulate the economy.

Population Movements, Migrations

With the start of the construction phase of the project, the need for labour will increase, and therefore, it is likely that the people seeking jobs from neighboring villages and districts will come to the region. Given that the job opportunities created by the project are limited to 250 in the construction phase and 8 people during the operation and that part of this manpower requirement will be selected from unskilled workers, it is not expected to have a great impact on the existing structure.

No external migration is expected due to the fact that large areas will not be used in the scope of the project and that the local people will be able to survive as they are already present.

Education

It is foreseen that the plant planned to be established in Aydın province, which is rich in geothermal resources, will contribute to the training of qualified personnel in the region and increase the living standards of the personnel to be employed.

The training project is planned to raise qualified personnel in agriculture, greenhouse and geothermal fields within the scope of the work of Yamantürk Vocational Higher School, which is funded by the investor company, and it can be interpreted as indirect impact of the facilities of the investor company in the region on education.



Figure 116 Yamantürk Vocational High School project

The project is expected to increase commercial activity throughout Germencik. With the project of Yamantürk Vocational Higher School, it will be possible for the region's rich geothermal resources to be used in the most appropriate way with qualified manpower resulting with the employment.

The planned university will also play an important role in R&D projects in the region and Germencik district will continue to be a brand city in education. In the light of modern science, the project of this vocational higher school is supported by the company in order to educate students who use the opportunities of information age in the best way, produce value, open to innovations, develop projects, have environmental awareness, and use their natural and cultural resources in the best way.

Yamantürk Vocational Higher School project has been given the following view from the construction works and the facility is planned to be operational within one year.



Figure 117 Construction of Yamantürk Vocational High School, January 2017

III.3.2. Environmental Cost-Benefit Analysis

The project is expected to contribute significantly to the national electricity power network. Geothermal power plants are activities that support environmental protection as the cleanest source of energy production by themselves with a good planning and design.

It is the geothermal power plants with one of the lowest environmental impact among renewable energy sources. The fact that the energy loaded from the ground is pushed back to the ground after being used for electricity generation ensures the continuity of the energy production in question. In addition, for these power plants, as in hydroelectric power plants, natural environment change, river beds, water supply reduction and large construction activities are not required to be very environmentally friendly investments. In addition to all these benefits, geothermal power plant has to find the appropriate place, each geothermal resource is not suitable for energy production and where production is required to be in the weak aspects of these projects are emerging.

Noise and dust formation will occur in the field preparation, construction and operation phases of the project. In addition, in the construction sites to be established and in the sections where daily construction works will be done, the workers will have the possibility of forming domestic solid waste and wastewater. The temporary storage and subsequent permanent disposal of the excavation material that will emerge during the construction works are also an important source of environmental impact. In addition, the management of hazardous wastes within the scope of the project will be carried out in accordance with the legislation. Activities and investments to be carried out to minimize the effects will be monitored and audited.

The environmental benefits of the project can be listed as:

- It is much cleaner than the types of electricity production, such as nuclear power plants, thermal power plants, etc.,
- The country's use of renewable resources,
- It will enable the country to close its energy deficit,
- Improvement of the roads in and around the project area,
- Reducing unemployment rate in the region,
- To prevent young people from emigrating from the region,
- New business areas will be opened and economic mobility will be provided.

III.3.3. Expropriation and/or resettlement

The project subject of the activity takes place at Aydin province, Germencik district, Mesudiye quarter, Seyrekkovalık Location, 141st Land with the parcels of 121, 133, 119, 97, 102 147 and 245th Land with parcel 147 which totally equals to 32.283,345 m² surface area, and the land belongs to the investing company. Since the investor is the owner of the land, no expropriation will be required.

Project area, according to the 1/100.000 scaled Aydın-Muğla-Denizli Region Environmental Layout Plan remains in the field of agriculture. In the scope of the project, as the Land Protection and Land Use Law no.5403 will be effective, according to the subparagraph (a) of the Article 21 of the Law, no non-agricultural activity will be carried out in the project area within the process of obtaining legal permits.

Within the scope of the project, the provisions of the "Geothermal Resources and Natural Mineral Waters Law" No. 5686 will be complied with.

CHAPTER IV

PUBLIC PARTICIPATION

CHAPTER IV. PUBLIC PARTICIPATION

IV.1. Identification of the people likely to be affected by the project (how and by which methods the local people are informed) and recommended methods for reflecting public opinion to the environmental impact assessment study (reflecting the views of the public about the project and the explanations related to the subject to the EIA report)

The project will firstly affect the local people who live in residential areas close to the project area. The local people who live in the region and make their livelihoods will be primarily affected from the project. In addition, the people of the region who live in neighbourhoods will be indirectly affected. In Section II, the distance of the settlement units located in the project area and close vicinity to the project units is given in detail.

During the EIA studies related to the project, the study group visited the region many times to make investigations in the field of the project and informed the local people as much as possible about the project and tried to get opinions and opinions of the local people on the subject.

Environmental Impact Assessment Directive, published in Official Gazette No. 29186 on 25.11.2014 within the framework of EIA studies related to the project, entered into force after being published in the 9th Environmental Impact Assessment Directive No. 29186 on 25.11.2014. In order to inform the public about the investment and to receive their opinions and suggestions regarding the project before the scope and special format determination meeting, "Public Participation Meeting in EIA Process" was held in the Conference Hall of Germencik Municipality.

After reaching agreement with Aydın Provincial Directorate of Environment and Urbanisation on the location and time of the participation meeting of the people, the meeting was held at the place where the local people from settlements to be affected most could easily reach.

For the participation meetings of the public, information correspondence was made on the settlements likely to be affected by the project, and the announcement text, including the content, date and time of the meeting, was published in national and local newspapers and a large number of interested parties were allowed to attend the meeting. In addition, advertisement texts were sent to the relevant muhtars in the settlements near the project area for the meeting and announcements were made to the public with information about the meetings in the settlements.

Public Participation Meeting within the scope of "Efe-7 Geothermal Power Plant" project, was announced to notify the time and place of the meeting for the participation of people in Aydın Province through the local newspapers (10.12.2013 dated Denge newspaper) and a national newspaper (10.12.2016 dated Hürses newspaper).



Figure 118 Advertisements in nation-wide and local newspapers

The Public Participation Meeting of the Efe-8 Geothermal Power Plant project was held at 13:30 on the same day and in the same hall together with the EFE-7 Geothermal Power Plant project and the participants were informed about the potential impacts of the project.

The “EFE-7 Geothermal Power Plant” project participation meeting was initiated by Baytekin Bülbül, Director of Aydın Environmental and Urbanisation Provincial Directorate, EIA and environmental permissions department at 15:00, and then the meeting was ended by the chairman of the meeting. The meeting minutes and the list of participants, signed by the Ministry of Environment and Urbanism, Aydın Environment and Urbanism Provincial Directorate and Almer project officials, were presented in Annex-11.

IV.2. Other parties advised to refer their opinion

If the necessary views and permits regarding the planned project are requested by the commission established by the Ministry of Environment and Urbanisation, they will be taken from the relevant institutions and organizations within the framework of the legislation in force.

The impact of geothermal projects in the Aydın province is considered as the agenda for various workshops from time to time. Finally, statements have been made by Mr. Ömer Faruk Koçak, the Governor of Aydın. Within this scope, the subject of Aydın Ses newspaper on 18.01.2013 is detailed as follows.

“Fund to be Established for Geothermal”

Governor Koçak answered the questions of correspondents during the second half of the meeting. The Governor answered a question on the geothermal as: *“There have been opinions from many groups on the subject. I tried to study it in detail. It's not my specialty, but I'm as interested in what the manager should know. We know that we are looking at something useful. When geothermal companies came to Aydın, there was a great excitement. After a certain period of time, this excitement gradually became a conflict of concern. There's going to be a camp. If there is a camp, it becomes impossible to accept what someone says by others. People and institutions who think in the interest of the public away from this camp should work in this direction. There's been a breach of trust. First of all, this has to be removed. No one will believe them if geothermal companies do a research. If geothermal opponents did a study, it would not be convincing. I say these things regardless of whether or not they are true. For this purpose, institutions or institutions that are not affiliated with anyone or that are in the public domain should do so. We're thinking of doing this. We're about to sharpen the model. We don't have time to rush. If we hurry, the problem will become chronic and make it worse. First of all, we have to work to build trust. If everyone is going to be involved, a committee can be formed and this work can be done. It can be argued how competent this delegation is. Secondly, it can be done to an impartial institution that has no connection to anyone who has been fully recognized internationally. It's important who pays for it. This cost can be shared by stakeholders. We're close to the second model. We can create a fund and invite stakeholders.”*

Koçak emphasized the need for the diversification of the use of geothermal resources and added, *“We are the richest city in Turkey in terms of geothermal resources. We use this source in one way and only generate electricity. When we evaluate our capacity, we have the capacity to change the region even when it is used in an integrated way, such as House heating, industrial use, cooling and heating, greenhouse. One way to use it now does not mean that it will not be used in different ways. This needs to be done by putting the report to be created. We'll determine a road map. We're not rushing. Geothermal is our source of wealth, our source of prosperity. It should not be the source of our misery when it is a resource that will raise our quality of life to serve our well-being and happiness.”*

CHAPTER V

IMPACTS AFTER AND SURVIVING THE TERMINATION OF THE OPERATION, AND MEASURES TO BE TAKEN AGAINST THESE IMPACTS

CHAPTER V. IMPACTS AFTER AND SURVIVING THE TERMINATION OF THE OPERATION, AND MEASURES TO BE TAKEN AGAINST THESE IMPACTS

V.1. Rehabilitation and reclamation

After the operation is ended, field rehabilitation and rehabilitation works will be performed in the facility area. The aim of the field improvement and rehabilitation operations is to arrange the areas that are disturbed due to the operation activities, to ensure stability, to fix, to spread the surface soil, to plant seed, to plant, to create recreational areas in suitable places, to plant and to make plantation operations. After the facility is closed to operation, all units within the facility will continue to be removed from the field in accordance with the purpose of rehabilitation work.

The field arrangement, which is likely to be needed, will be completed using fillers and surface drainage will be taken into consideration while the work being carried out. At the end of the rehabilitation work, soil surface will be covered with the selection of appropriate vegetation.

Following the end of the plant activity, equipment and buildings will be removed and the materials and equipment that will be produced will be considered as scrap. In general, field improvement includes field renovation, field leveling and shaping. This will cover the process of re-planting of all the degraded areas and areas within the framework of future use planning in order to encourage natural selection.

In order to ensure the economic life of the project planned to be realized, it will be ensured that the equipment is maintained regularly and that the equipment that has expired operating life will be renewed and re-operated.

V.2. Impacts on existing water sources and measures to be taken

After the project is closed to the operation, there is no expected impact on water resources. The Efe-7 Geothermal Power Plant project, which is planned to be realized, the wells will be safely shut down after the operation is ended and will not have any adverse effect on the existing water resources.

V.3. Potential impacts to underground and measures to be taken

In order to determine the earthquake risk of the project area, surveys in Aydın and near the city were investigated and in the area after 1904, the earthquakes with the magnitude over 5 were found by scanning the current earthquake data. Accordingly, given the maps of the Aydın and the vicinity of the most active seismic region in Turkey is taken into consideration. The Aydın - Nazilli fault in the vicinity is a live fault and has maintained its activity from time to time.

Since the geothermal resources are located in regions having seismic movements, the seismic movements in the region is seen as the natural with reference to the planned project.

Because the geothermal fluid used in the facility is given again to underground, the water balance of the reservoir will not deteriorate and the pressure of the reservoir will be preserved. The production period of the reservoir will be extended with the application of the oppressing process. Thus, as a result of the decrease in reservoir volume due to production, the ground collapses will be minimized.

Within the scope of the planned Efe-7 Geothermal Power Plant project, seismic effects from activity are not expected in all phases of the project.

CHAPTER VI

ALTERNATIVES TO THE PROJECT

CHAPTER VI. ALTERNATIVES TO THE PROJECT

(In this section, site selection, technology, measures to be taken, comparison of alternatives and, preference ranking will be specified)

Geothermal energy and technology in today's world is recognized by all countries and the environment as a power source.

As is known, with the development of technology, industry and population growth, our world has faced intense demand for energy. Meeting this demand is largely from fossil sources. However, considering the danger of depletion of fossil fuels and the damage it has caused to the environment, it is inevitable to turn to alternative energy sources. Geothermal energy is one of the most important sources of energy.

Turkey has a geothermal energy potential with compare to other countries. In our country, the increase in installed power in the production of electricity, the energy dependence on the outside is reduced. At the same time, the development of this sector will create employment opportunities. On the other hand, the importance of geothermal energy for the use and evaluation of local resources is once again understood.

Alternatives to Project Technologies

Below criteria were considered for the determination of the technology and capacity of Efe7 Geothermal Power Plant by Gürmat Elektrik Üretim A.Ş.:

- Power needs of our country,
- Advantages with compare to the facilities such as thermal and nuclear power plants in terms of ease of operation and economy,
- Geothermal characteristics in the region,
- Service and convenience,
- Minimum level of impact in terms of noise pollution,

In addition to the water and carbon dioxide losses that occur when generating energy by conventional methods; the losses caused by the distance between the place where energy is used and where it is produced; the problem of transporting gas, solid and liquid fuels and the related accidents occurring from time to time, if these facilities are away from residential areas, the safety with the fact that the costs of oil, gas and coal will increase over time, the electricity obtained from geothermal has taken great distance towards entering the smart solutions.

The project will produce electricity from geothermal energy source and the project itself is an alternative energy generation project. For this reason, no alternative was specified for the project.

Alternatives to Project Location

The operations of other geothermal facilities of Gürmat Elektrik Üretim A.Ş. keep going on in Aydın Province, Germencik sub-province within the license field, currently.

As a result of the feasibility studies carried out at the point, the Efe-7 geothermal power plant project is planned to be realized.

One of the factors in selecting the project site is that the geothermal resource is sufficient to produce electricity within the license area. However, the availability of spare parts and qualified personnel in an easy and short time can be listed as important advantages.

The technology to be used in the operating phase of the activity is modern and practical technology, and is still applied in similar facilities. Therefore, it is thought that the technology chosen for energy production will provide optimum conditions. Project technology is capable of adapting to the studies to be carried out in the stage of minimizing the environmental impacts likely to occur from the project.

The most important parameter for the feasibility of the investment is that the area to be selected for the plant is in the region where the raw material is located. At this point, the criteria that should be considered as priority during the evaluation of alternatives should be the technology and environmental impacts to be used.

This geothermal resource, located within the borders of the Germencik sub-province of Aydın Province is the largest known area of our country and is the first place to be considered for energy purposes. For many years, the real power of the field was expected to contribute to the economy, and this project based on the power plant will bring this power to the country's economy and achieve this goal at the highest level.

In this context, considering the fact that the raw material to be used will be covered from the investor's licensed site, and the other geothermal power plants operating in the region of the investor firm, no other field alternative was sought.

When the existing alternatives are examined, the planned Efe-7 geothermal power plant has no another alternative in terms of suitability and economy of the location chosen for the operation and the production method.

CHAPTER VII.

**OBLIGATION TO PROVIDE INFORMATION ON DEVELOPMENTS IN THE
BEGINNING AND CONSTRUCTION PERIODS**

CHAPTER VII. OBLIGATION TO PROVIDE INFORMATION ON DEVELOPMENTS IN THE BEGINNING AND CONSTRUCTION PERIODS

(Schedule related to the suggested obligation to notify and provide information regarding construction of the activity, environmental management plan and emergency action plan, in case of EIA Positive Certificate, procedures to be carried out within the scope of the Competence Communiqué)

Pursuant to the Article 18 – (3) of the Environmental Impact Assessment Directive to be effective after its publishment in the Official Gazette no: 29186 on 25.11.2011, "after receiving the "EIA positive "decision, the project owner is obliged to make the reports regarding the start-up, construction period of the investment to the institutions/organizations authorized by the ministry, and to submit these reports to the ministry within the periods determined by the commission."

Pursuant to the Article 27/B – (1) "Notification and Informing Obligation" of the Directive on the Amendment on the Environmental Impact Assessment Directive to be effective after its publishment in the Official Gazette no: 29619 on 09.02.2016, after receiving the "EIA positive" decision, the project owner is obliged to inform the Ministry for the progress recorded in the investment process in the periods determined by the commission for the start of the investment and the construction phases through the organisation / establishment to be authorised by the Ministry."

In the current situation, the Ministry of Environment and Urbanisation of the Republic of Turkey states in the letter dated 17.02.2013 and numbered 2766; *'Accordingly, in accordance with the said court decision, 28 of Law No. 2577.I would like your information and the necessity of making the necessary arrangements on the e-EIA system and to give an end to the applications for the request of notification forms as the project which has been decided "EIA positive" by the qualified companies in accordance with the provisions of the present article.'*

For this reason, necessary applications will be made as determined by EIA permission and Audit Directorate General within the scope of the notification process regarding the start and construction period of the investment.

Control studies and disposal methods to be carried out within the scope of the project will be carried out within the program given below.

Table 80. Control schedule

PHASE		MEASUR
Field Preparation and Construction Phase	Historical, cultural and archaeological assets	In the implementation phase of the project (land preparation and construction) in case of any cultural and natural property is found, the works will be stopped immediately and the nearest museum or civil administration will be informed.
	Excavation Works	The material to be produced within the scope of excavation works to be realized within the scope of the project will be used for filling operations and the unused part of the filling will be taken to the area specified by the Municipality of Germencik.
	Air Emissions	In order to minimize the dust emissions that will occur during the preparation and construction of the land, irrigation will be done with the field on the road routes, filling and unloading operations will be done without wastage, and the vehicles will be covered with canvas during transportation of the materials and the top of the material will be kept at 10% humidity.
	Vehicle Emissions	In order to minimize emissions from vehicles, routine inspections of all vehicles and equipment to be used will be carried out and maintenance of vehicles will be taken into care and other vehicles will be used in the studies until their maintenance is finished. In addition, they will be warned to work in accordance with the traffic law and pay attention to the installation in accordance with the loading standards.
	Enabling the Ground Safety	All construction works within the scope of the project shall be carried out in accordance with the provisions of the "Directive on Buildings to be Constructed in Disaster Zones".
	Waste Water	Waste water after use will be completely home-quality waste water characteristics. In accordance with the provisions of the "Directive on the Pits to be Constructed in Places not Possible Having Sewage System", which was published in the Official Gazette dated 19.03.1971 and numbered 13783, the domestic quality waste will be collected in the septic tank without any leak during the construction period and the disposal of the relevant material will be provided.
	Waste Waters and Packaging Wastes	The domestic solid wastes resulting from the personnel to work in the project will be collected in closed waste bins placed at various points in the field. These solid wastes that will be collected in containers will be disposed of by giving them to the solid waste collection system of Germencik Municipality in certain periods. Land preparation and construction works will consist of solid wastes such as part iron, steel, sheet metal, packaging material and some of these wastes can not be determined because the amount of these wastes will change. However, waste will be collected as scrap, stored in a suitable place within the project area and recycling of possible wastes will be reused and / or license will be given to recycling companies. The wastes that are not recyclable will be disposed of by the Germencik Municipality solid waste collection system. In summary, all solid waste (food waste, etc.) that will be sourced from employees during the preparation and construction of the land employees will be warned that dumping into receiving environments, streets and forests is forbidden. The wastes within the scope of the Directive on Waste Management, no matter what the material used and at which it occurs, regardless of the source will be collected separately from other wastes and will be given to licensed companies.
	Waste Oil	The maintenance, repair and cleaning of the vehicles to be operated during the field preparation and construction phase shall not be carried out on the project site and shall be constructed in the nearest authorized services and/or fuel stations. However, if vehicle maintenance is to be performed on the project site, the provisions of "regulation on control of waste oils" shall be applied for the disposal of waste oils which are likely to occur in this case.
	Waste Plant Oils	Used frying oils will be collected in a clean and mouth-covered container separate from other wastes in the dining room to be established within the facility area. Used frying oils will not be poured into drains, soil, sea and other receptive environments in order to protect the environment. In this context, the provisions of the "Directive on the Control of Plant Waste Oils", which came into force after being published in the Official Gazette dated 06.06.2015 and numbered 29378 for the disposal of vegetable waste oils, will be fulfilled.
	Expired Tires	All other tires that have expired will be collected separately from the waste and sold to licensed companies. In this context, the provisions of "Directive on Control of Expired Tires", which came into force after being published in the Official Gazette No. 26357, dated November 25, 2006, will be fulfilled.

PHASE		MEASUR
Field Preparation and Construction Phase	Waste Batteries	In order to prevent batteries and accumulators that have completed their lifetime in operation from being placed directly or indirectly in the receiving environment in such a way as to cause harm to human health and the environment, the Article 13 of the "Waste Batteries and Accumulators Control Directive" to be published in the Official Gazette No. 25569 dated 31.08.2004 and entered into force, . As states that it will be collected separately from household waste and disposed of by handing over to licensed collection points and temporary storage places.
	Medical Wastes	Although it is difficult to foreseen the demand for the treatment inside the site, it is estimated that the amount of medical waste that will be very fess during the field preparation and construction phase. Medical waste will be disposed pursuant to the "Directive on the Control of Medical Waste" to be published in the Official Gazette dated 25.01.2013 and numbered 29959, the requirements shall be fulfilled in accordance with the provisions.
	Noise and Vibration	Noise will vary throughout the day, but since the work will be done during the day (07.00-19.00), noise formation will be limited. In the scope of the project, taking into consideration the conditions to be observed in road vehicles and the conditions to be observed in equipment used outdoors, necessary measures shall be taken to minimize noise formation. In addition, in the field of the project, the issues mentioned in the "Noise Criteria for Site Areas" regarding the noise that will occur during the construction phase will be followed and the vehicles that are carried out traffic inspections, exhaust measurements and maintenance will be used.
	Housing and Other Technical and Social Infrastructure Needs of the Personnel	Social needs of personnel to work within the scope of the project (accommodation, recreation, dining, etc.) will be supplied from the social facilities in the site to be established within the scope of the project. In addition, if needed, technical or social needs can be obtained from Germencik District if the project area is not met from the settlements around it. Staff will be able to benefit from health centers in Germencik District.
	Public Security	Warning signs, barriers, strips etc.will be placed during the studies to prevent the loss of life and property of the project.
	Transportation	Within the scope of the project, it will be observed that all transportation will be made through existing roads, supply will be returned alternately, all vehicles and equipment to be used will be routinely checked and maintenance will be taken into care, other vehicles will be used until the maintenance period is over, and loading will be carried out in accordance with the In all phases of the project, Road Traffic Law will be worked in accordance with all laws and regulations issued on highways.
	Work Health and Work Safety	During the construction phase of the project, construction works shall be carried out in accordance with the provisions of the labor law and all regulations issued pursuant to this law.
Operational Phase	Solid Waste and Packaging Wastes	Home-quality wastes will be collected in closed waste drums placed at various points within the project site and will be disposed of by giving them to the solid waste collection system of Germencik Municipality at certain periods. In the context of the "Packaging Waste Control Directive", which came into force after being published in the Official Gazette dated 24.08.2011 and numbered 28035, the wastes that are likely to occur as a result of improper packaging activities during the operation phase of the project will be collected separately from other solid wastes and delivered to the recycling company having the collection license. The solid wastes that are not possible to recycle, will be given to the solid waste system of Germencik Municipality.
	Noise	The only noise sources in the operational phase of the project will be machinery and equipment to operate within the operational building. Since the building will isolate noise, there will be no noise outside the building. For the employees who will work in the business building, the noise is stated in the "work law" in the areas where there is lots of noise, earplugs, etc. such protective clothing and equipment will be provided to ensure that they are not affected by the noise in the facility.
	Land Improvement and Reclamation Works	In the landscape works to be carried out after the completion of the construction works, rehabilitation of the damaged area will be carried out and the natural landscape value of the area will be restored. Thus, the environmental impacts in the construction and use process will be minimized and sustainability will be supported in the field, and the regional and local character will be strengthened against erosion risk due to the plant cover removed during the construction and operation phase and the erosion risk due to the top soil and slope.

PHASE		MEASUR
Operational Phase	Waste Water	Waste water after use will be completely home-quality waste water characteristics. In accordance with the provisions of the "Directive on the Pits to be Constructed in Places not Possible Having Sewage System", which was published in the Official Gazette dated 19.03.1971 and numbered 13783, the domestic quality waste will be collected in the septic tank without any leak during the construction period and the disposal of the relevant material will be provided.
	Vehicle Emissions	In order to minimise emissions from vehicles, the "Directive on Exhaust Gas Emission Control and the Quality of Petrol and Diesel", published in the Official Gazette dated 30.11.2013 and numbered 28837, will be used, and all vehicles and equipment that need to be cared for will be checked by routine controls and other vehicles will be used in the studies until their maintenance. In accordance with the traffic law, they will be warned about their work and especially pay attention to the loading standards.
	Air Emissions	In relation to emissions resulting from all plants, the limit values, conditions and measures specified in "SKHKKY" shall be complied with and the necessary measures shall be taken. All matters specified in the 'Directive on the Control of Industrial Air Pollution'(SKHKKY), which came into force after being published in the Official Gazette dated 03.07.2009 and numbered 27277, shall be complied with.
	Flood Prevention and Drainage	During construction, the necessary pumping measures will be taken into consideration that the tunnel waters and surface waters within the sand-gravel layer can come to the foundation while digging the foundation pit. In addition, the basement level surface and leakage water against the necessary insulation measures and drainage measures will be taken under the basic.
	Solid Waste	The wastes which are recovered from the wastes formed will be collected separately and collected in closed containers placed at various points of the project site. The waste that can be recycled will be disposed of by the licensed recycling companies and the waste that cannot be recycled will be disposed of by the Germencik Municipality's solid waste collection system. Domestic solid wastes that will occur (food scraps, etc. organic waste) to seas, lakes and similar receiving environment, streets and the employees will be notified of forest loss and waste management as required by the Waste Management Directive bans and all the considerations will be fulfilled.
	Packaging Waste	Packing paper, pet bottle, glass bottle etc. waste shall be collected separately from other wastes and shall be sold to licensed recovery companies, regardless of the material used and the source in which it is formed, in accordance with Article 23 of the "Packaging Waste Control Directive". In the case of packaging wastes falling under the scope of danger, disposal will be provided to licensed companies in this regard and wastes will be transported by licensed vehicles.
	Waste Oils	The disposal of waste oils that have expired in the scope of the project will be carried out at the licensed disposal facilities as specified in the second part of the "Waste Oil Control Directive" which came into effect after being published in the Official Gazette dated 30.07.2008 and numbered 26952. In addition, waste oils and solid wastes contaminated with hazardous substances will be disposed of by sending them to the licensed hazardous waste disposal facility. Waste Oil Control Directive conditions are provided, within the enterprise, according to the standards in temporary storage categories will be stored separately and will be provided to transport. Transport of waste oils to disposal facilities will be done through a licensed carrier. As it is stated in the Article 9 of the Waste Oil Control Directive, waste oil manufacturer obligations will be complied with.
	Waste Plant Oils	Used frying oils will be collected in a clean and mouth-covered container separate from other wastes in the dining room to be established within the facility area. Used frying oils will not be poured into drains, soil, sea and other receptive environments in order to protect the environment. In this context, the provisions of the "Directive on the Control of Plant Waste Oils", which came into force after being published in the Official Gazette dated 06.06.2015 and numbered 29378 for the disposal of vegetable waste oils, will be fulfilled.
	Waste Batteries	In order to prevent batteries and accumulators that have completed their lifetime in operation from being placed directly or indirectly in the receiving environment in such a way as to cause harm to human health and the environment, the Article 13 of the "Waste Batteries and Accumulators Control Directive" to be published in the Official Gazette No. 25569 dated 31.08.2004 and entered into force, . As states that it will be collected separately from household waste and disposed of by handing over to licensed collection points and temporary storage places.
	Expired Tires	All other tires that have expired will be collected separately from the waste and sold to licensed companies. In this context, the provisions of "Directive on Control of Expired Tires", which came into force after being published in the Official Gazette No. 26357, dated November 25, 2006, will be fulfilled.

PHASE		MEASUR
Operational Phase	Medical Waste	All possible medical waste in the facility; tear, puncture, explosion and transport resistant, medium density polyethylene raw material sealed, double bottom stitched and produced blind, double layer thickness 100 microns, at least 10 kilograms lifting capacity, on the face of the visible size and on both sides of the black "International biohazard" logo with Attention! Red coloured plastic bags bearing the phrase" medical waste" will be used. The bags will be filled with a maximum of ¾ ratio, their mouths will be firmly connected and, where necessary, each bag will be placed in another bag with the same characteristics and sealing will be ensured. The contents of the medical waste bags shall not be compacted, removed, emptied, and transferred to another container in any way. Waste that has the characteristic of cutting and piercing apart from other medical waste, tear, fracture and explosion resistant, waterproof and non-sealed, opening and mixing impossible, black coloured "International Bio-purity" emblem with black letters "attention! It shall be collected in containers or containers made of plastic or laminated carton with the same characteristics as" cutting and piercing medical waste". These storage containers will be filled with a maximum of ¾, their mouths will be closed and placed in medical waste bags. After the breaker-piercing waste containers are filled, they will absolutely not be compressed, opened or emptied.
	Noise and Vibration	Noise measurements shall be made after the plants have started operating and, in the case of noise above the limit values in the noise measurement results, the employees shall be notified of the noise in accordance with the "Occupational Health and Safety Act no.6331", earplugs, earplugs, etc. such protective clothing and equipment shall be provided.
	Work Health and Work Safety	In the operational phase of the project, all health and safety rules determined by the regulations in order to prevent all possible risks to human health and occupational health and safety shall be followed by the relevant legislation numbered 6331 on Occupational Health and Safety. Within the scope of the project, the General Public Health Law No: 1593 and the regulations issued pursuant to these law shall be complied with.
	Public Security	Warning signs, barriers, strips etc.will be placed during the studies to prevent the loss of life and property of the project.
	Transportation	Within the scope of the project, it will be observed that all transportation will be made through existing roads, supply will be returned alternately, all vehicles and equipment to be used will be routinely checked and maintenance will be taken into care, other vehicles will be used until the maintenance period is over, and loading will be carried out in accordance with the In all phases of the project, Road Traffic Law will be worked in accordance with all laws and regulations issued on highways.
	Housing and Other Technical and Social Infrastructure Needs of the Personnel	The personnel who will work in the project will be provided from the region as much as possible and housing and other technical/social infrastructure needs will be provided from Germencik and Incirliova districts and close residential areas for people coming from outside the region.
	Landscape	Landscaping will be carried out in order to eliminate visual pollution within the scope of the project.

The risk of accidents related to the technology and materials to be used during the site preparation and construction period of the planned project is very low in case of strictly complying with the Occupational Health and Safety legislation during construction work. The policies and procedures will be considered in each phase of the construction and the activities will be performed pursuant to Occupational Health and Safety and other related effective legislation .

In order to be able to intervene immediately in natural disasters such as flood, earthquake, fire, sabotage and industrial accidents, to minimize the damages that may occur and to prevent the environmental effects of this, the organization will be organized among the personnel. According to this organization, Protection, Fire, Rescue and First Aid teams will be created. The working principles of these teams shall be determined separately and a general coordinator shall be appointed in charge of all organisational processes.

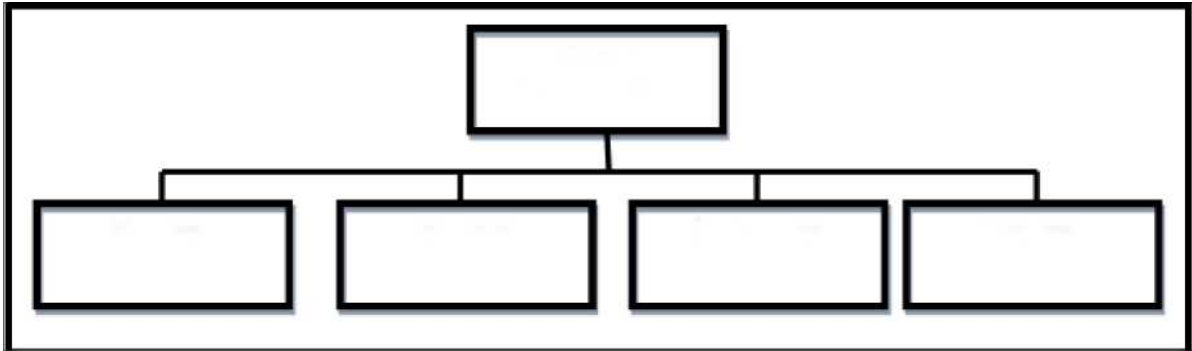


Figure 119 Coordination structure of the emergency action plan

The priority in case of emergencies which may be encountered in the plant is given below.

- ✓ Enabling the communication,
- ✓ Enabling the transportation and regulation of traffic,
- ✓ Rescue,
- ✓ Medical first aid
- ✓ Hospital transfer of patients and injured patients
- ✓ Fire fighting
- ✓ Ensuring safety and order
- ✓ Feeding, dressing, heating and lighting
- ✓ Enabling the temporary shelter
- ✓ Bury of deceased
- ✓ Debris removal and cleanup
- ✓ Arrangement of infrastructure facilities
- ✓ Taking quarantine measures

The duties and responsibilities of the teams to be formed within the scope of the emergency plan have been determined and summarized below:

Duties and Responsibilities of Protection Team

The duties and responsibilities of the protection team are as follows:

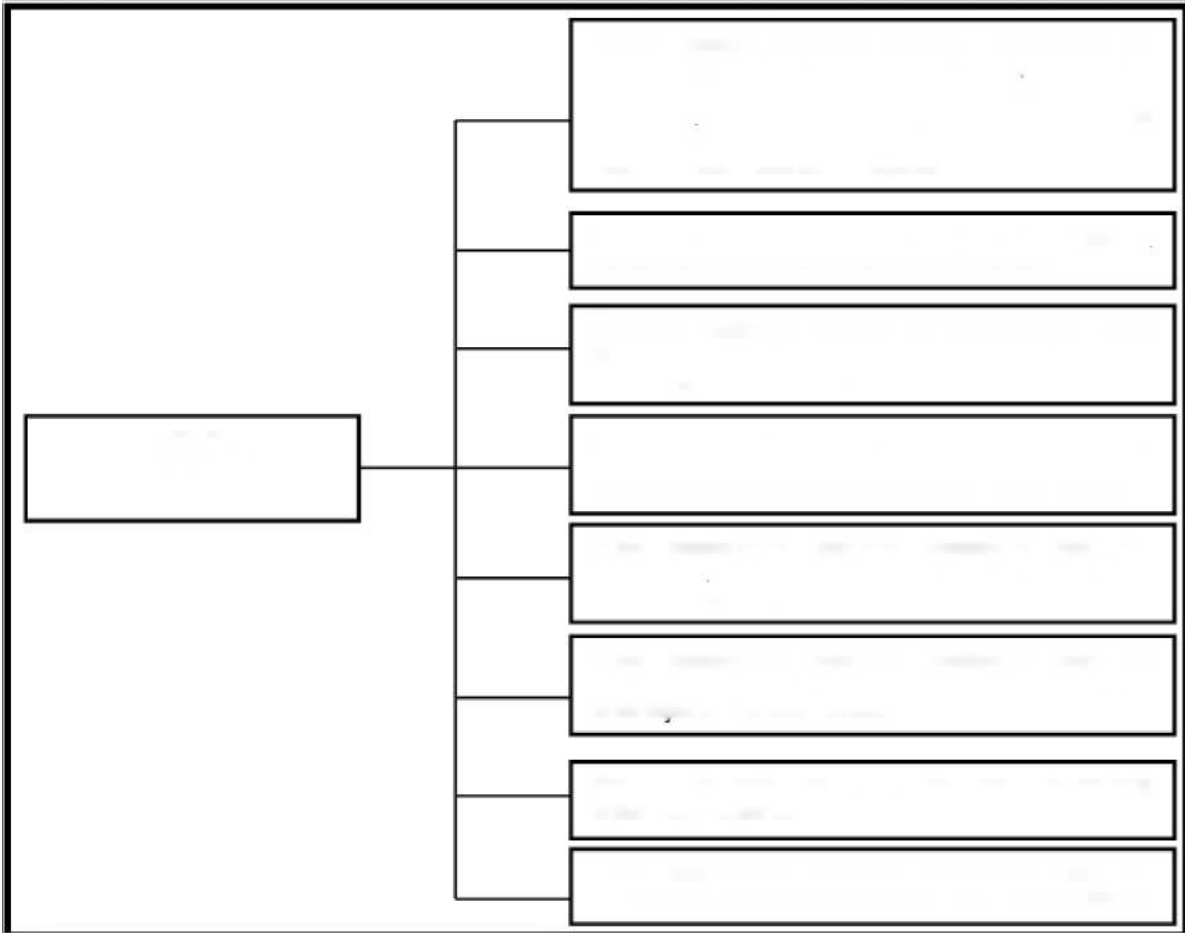


Figure 120 Duties and responsibilities of the protection team

Duties and Responsibilities of the Rescue Team

The duties and responsibilities of the rescue team are as follows:

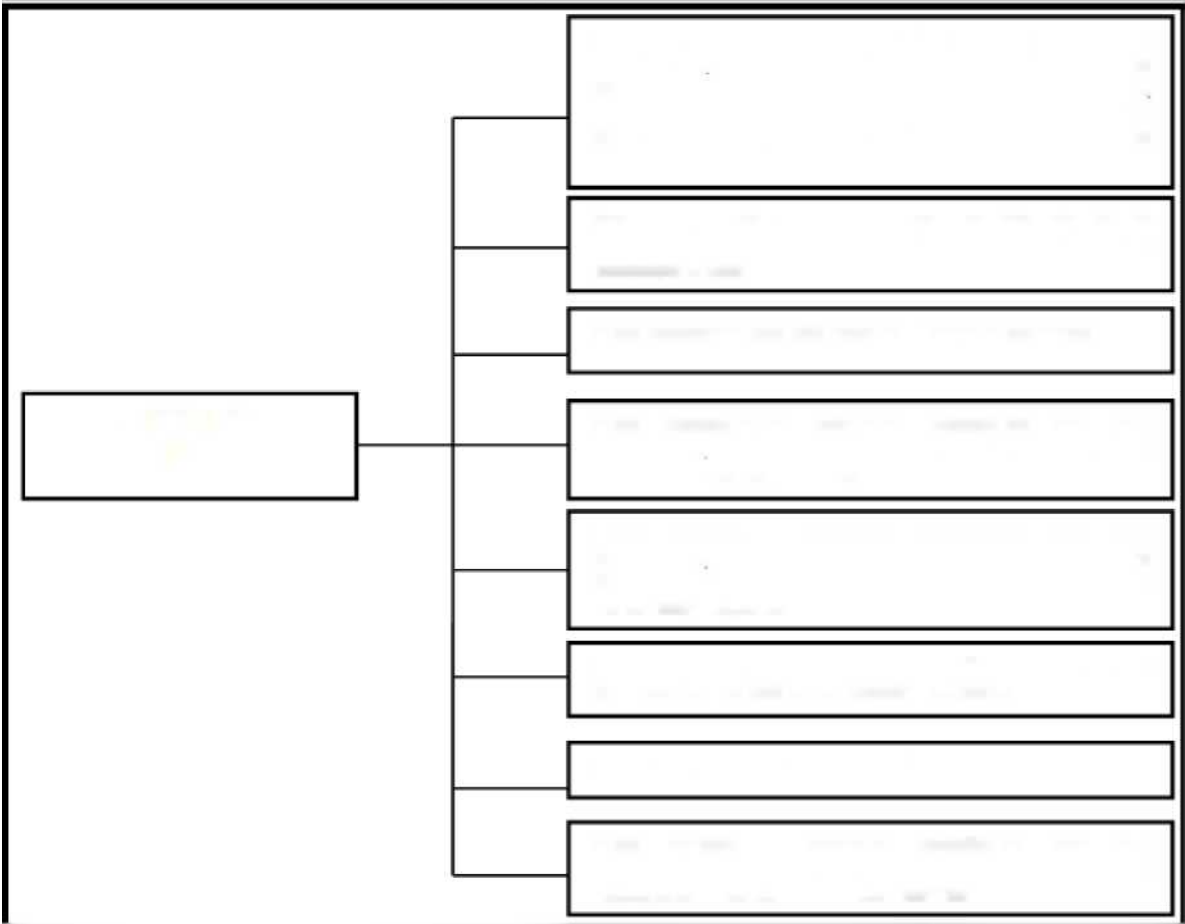


Figure 121 Duties and responsibilities of the rescue team

Duties and Responsibilities of the First Aid Team

The duties and responsibilities of the first aid team are as follows:

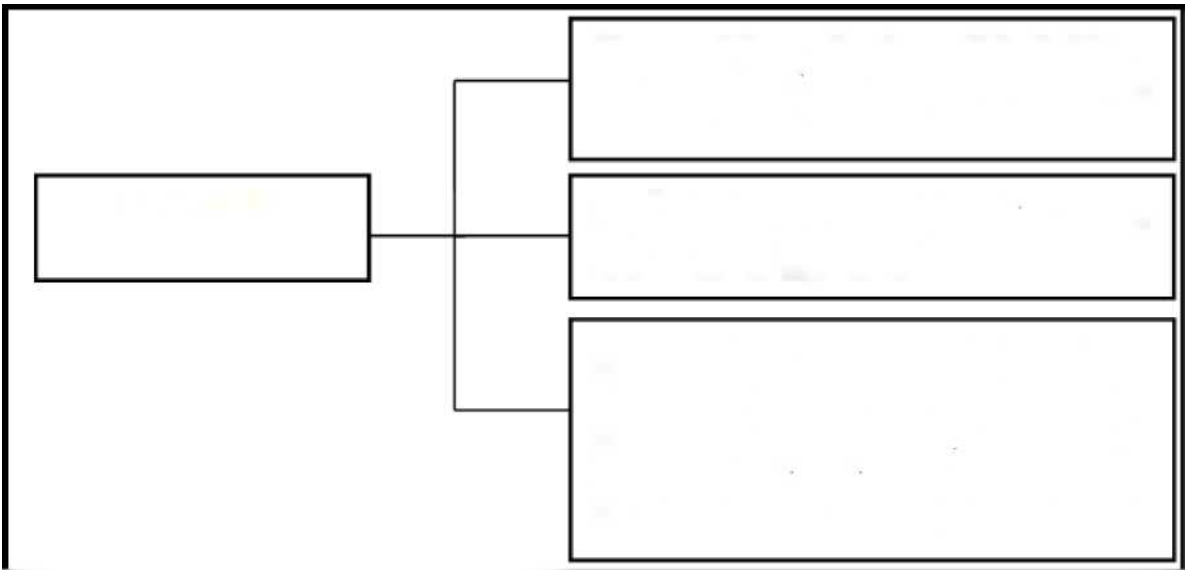


Figure 122. Duties and responsibilities of the first aid team

Duties and Responsibilities of the Fire Fighting Team

The duties and responsibilities of the fire fighting team are as follows.

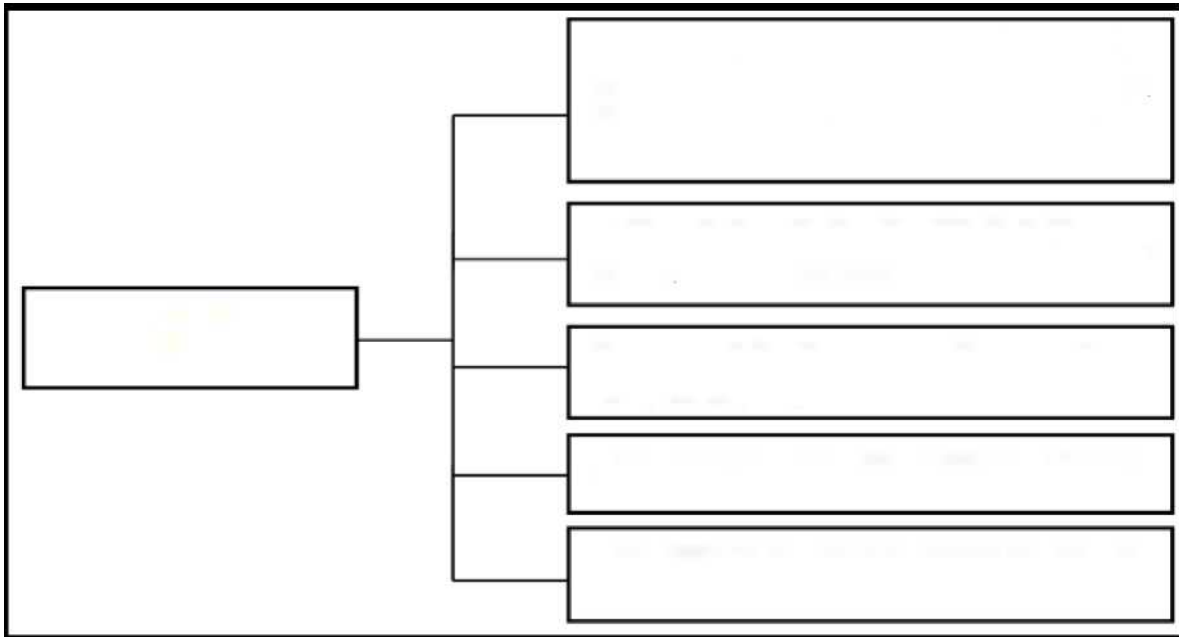


Figure 123. Duties and responsibilities of the fire fighting team

Work accidents can occur as a result of possible carelessness in the use of vehicles, machinery and equipment to be used during construction work. In order to reduce and prevent all these accidents, necessary warnings will be given to employees and warning signs will be hung.

The first aid kit shall be established by supplying the first aid materials and supplies specified in the “Directive on Occupational Health and Safety” concerning the workplace. The measures specified in the Directive on Occupational Health and Safety shall be taken in relation to the project.

The personnel who will work within the scope of the project will be held periodically and the necessary health examinations which will be carried out and recorded.

As a result, during the construction and operational period of the project, all necessary measures will be taken. In all phases of the project, the provisions of the Labour Law and the directives to be issued in accordance with the Labor Law shall be complied with and necessary measures shall be taken to minimize all possible accidents and risks.

The “Emergency Action Plan” to be prepared within the scope of the project is presented in Annex-14.

CHAPTER VIII

CONCLUSIONS

CHAPTER VIII. CONCLUSIONS

(Summary of all explanations, general assessment of the of the extent to which success can be achieved in preventing the negative environmental impacts if the project is implemented, listing the significant environmental impacts of the project, general assessment of the of the extent to which success can be achieved in preventing the negative environmental impacts if the project is implemented, listing the significant environmental impacts of the project, choices among alternatives within the scope of the project and reasons for these choices)

Gürmat Elektrik Üretim A.Ş. plans to establish and operate the Efe-7 Geothermal Power Plant in order to generate electricity by evaluating the geothermal resource in the license area.

Project subject activity in Aydın province, Germencik Sub-province, Mesudiye District, Seyrekkovalık Location, plot 141 and parcels 121, 133, 119, 97, 102 and plot 245, parcel 147 totally 32,283,345 m² area is planned and the ownership of the project subject parcels belongs to the investor company.

The parcels on which Gürmat Elektrik Üretim A.Ş. plans to establish Efe-7 geothermal power plant is located in the south of the geothermal energy plant, which is currently operating in the current situation, and it is planned to use the pool unit of the existing facilities of the planned facility.

The planned project will be realized within the borders of the “geothermal resources and natural mineral waters operating license” field no. J-553 registered on behalf of the operator. The operating license number J-553 is 3.530 hectares. Production and reengineering wells to be used within the scope of the project, Kuyubaşı facilities, distribution lines, etc. the buildings will be located within the site of operation license number J-553.

Geothermal power plants, energy and technology in today's world accepted by all countries and the environment, the benefits are unquestionable and renewable energy source.

As is known, with the development of technology, industry and population growth, the world has faced intense demand for energy. This demand is met largely from fossil sources. However, considering the danger of depletion of fossil fuels and the damage it has caused to the environment, it is inevitable that we turn to alternative energy sources. Here are one of the most important of these resources is geothermal.

The following criteria are taken into consideration when determining the technology and capacity of the planned Efe-7 GPP:

- Power needs of our country,
- Advantages with compare to the facilities such as thermal and nuclear power plants in terms of ease of operation and economy,
- Geothermal characteristics in the region,
- Service and convenience,
- Minimum level of impact in terms of noise pollution,

The project will generate electricity from geothermal energy sources and the project itself is an alternative energy generation project. For this reason, no alternative was specified for the project.

The most important reason for selecting the project site is that the area where geothermal power plants will be installed has to be within the scope of the license area and the geothermal resource properties are sufficient to produce electricity. However, the availability of spare parts and qualified personnel in an easy and short time can be listed as important advantages.

The technology to be used in the operating phase of the activity is modern and practical technology, and is still applied in similar facilities. Therefore, it is thought that the technology chosen for energy production will provide optimum conditions. Project technology is capable of adapting to the studies to be carried out in the stage of minimizing the environmental impacts likely to occur from the project.

In this context, when the existing alternatives are examined, there is no other alternative for the suitability and economy of the geothermal power plant, the place chosen for the operation and the production method.

Possible Environmental Impacts of the Project during the Construction and the Measures to be Taken;

Construction works will be carried out within the scope of Efe-7 Geothermal Power Plant project.

Within the scope of the project, 20 cm thick vegetable soil from the soil surface will be gradually removed and stored where the slope will not exceed 5% within the framework of the standards stated in the "Directive on Control of Excavation Land, Construction and Debris Wastes" and will be used in the field's landscape studies. Harvesting of plant soil will not be done any crushing and grinding process. Any flammable, explosive, dangerous, toxic and chemical substances will not be used during construction work. Work machines will be used during the work to be done.

A small amount of concrete will be needed during construction within the scope of the project. At this stage, it will be provided by purchasing ready-mixed concrete from the market. However, there will be no quarries in the scope of the project.

The excavated surplus material to be removed from the field will be collected in a suitable place on the field and then used again in the field and filling arrangements. During all excavation works to be carried out within the scope of the project, the provisions of the "Directive on Control of Excavation Land, Construction and Debris Wastes", which came into effect after being published in the Official Gazette dated 18.03.2004 and numbered 25406, will be complied with.

During construction work of the project, dust emissions will be generated. In the field of the project, the dust emission during the production, unloading and transportation processes during construction works was calculated by taking into account the dust emission factors given in the Directive on the Control of Industrial Air Pollution.

During the construction phase all transactions will not be carried out at the same time. Within the scope of the project, the necessary excavation and filling will be done after the removal of the vegetable soil layer. The construction works of the project will be started with field organization.

The construction phase of the project is planned to be completed in 12 months.

In the calculations performed for all the studies, "Calculation of Contribution to Air Pollution" is not required with the use of an internationally accepted distribution model in the facility domain because the contaminant mass flow rate specified in Annex-2 to SKHKY is exceeded by assuming that all operations will be performed at the same time.

In the field preparation and construction phase of the planned project, there will be environmental noise induced by construction machinery and equipment which will work in the field of activity.

In the calculations carried out in EIA report III.1.14, noise levels of construction stage; in comparison with noise limit values specified in Annex VII Table-5, it is observed that 70 dBA limit value was obtained after 125 m distance during construction stage. Therefore, the construction works to be realized within the planned project will not have any negative impact on the settlements.

During the construction phase of the project, regular maintenance of all machinery and equipment that will cause noise will be carried out and renewed when their economic life expire. Personal protective equipment (earphone, etc.) will be provided to use the internal ambient noise measurement will be done periodically and continuous control will be provided.

During the construction phase of the EFE-7 Geothermal Power Plant project, there will be a domestic solid waste generated by the personnel. Domestic solid wastes resulting from personnel during construction phase of the activity, according to their characteristics within the project area (organic, glass, plastic, paper, metal, etc.) collected separately in containers, in terms of appearance, dust, odour and similar factors will be kept in closed containers that do not pollute the environment.

The provisions of the "Waste Management Directive" to be published in the Official Gazette no: 29314 on 02.04.2015 shall be complied with when collecting, storing and transporting household solid wastes.

In accordance with the "Packaging Waste Control Directive" and all amendments to be made in this Directive, the recyclable wastes that will occur during the construction phase of the project will be collected separately from the other solid wastes and delivered to the company at certain intervals within the contract to be made with the company holding the packaging waste collection license.

During the studies to be carried out, the "Directive on Control of Soil Pollution and on Point-Borne Contaminated Areas" (amended OG-14.6.2012-28323, OG-11.7.2013-28704), which was published in the Official Gazette dated 08.06.2010 and numbered 27605, will be carried out in accordingly.

Waste oils that are likely to occur during the construction phase of the project can be listed as waste oils that may occur as a result of the maintenance-repair process of the construction machinery to be used during the work. However, contaminated packaging, tops, contaminated work clothes, etc. that are likely to occur. it can be classified as hazardous waste.

Maintenance and repair works of the work machines to be used during the

construction phase shall be carried out at the authorized maintenance and repair stations outside the scope of the work. However, machinery and equipment maintenance-repair of the project site in cases where it is mandatory to occur for disposal of possible waste oil will be achieved according to the "Directive on Control of Waste Oils" to be published in the Official Gazette dated 30.07.2008 and numbered 26952 (amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812).

In the event of the occurrence of hazardous waste in the construction phase, these wastes will be separated according to their type, sealed in sealed containers for each type of waste to be built to be found in the temporary waste storage area will be stored. In each section of temporary waste storage to be built, the information to identify the wastes to be stored (name, waste code, etc.) will be marked on containers.

Since maintenance and repair of vehicles and equipment to be used within the scope of construction works of the project will be done at authorized service stations outside the scope of activities, accumulator changes will be made outside the facility. Waste accumulators will also be given to the service where the new accumulator is purchased.

The vehicle tires likely to be sourced from vehicles that will operate during the construction phase of the activity shall be provided with floor imperfection in accordance with the provisions of the "Directive on Control of Expired Tires" (amended: OG-30.03.2010-27537, OG-10.11.2013-28817, OG-11.3.2015 - 29292) dated 25.11.2006 and numbered 26357 and shall be stored in a closed fields and delivered to the recycling company having permission from the Ministry of Environment and Urbanisation.

The waste water that will occur after the use with the acceptance that 100% of the water to be used will return as waste water will be completely home-made waste water characteristics. In accordance with the provisions of the "Directive on the Pits to be Constructed in Places without Sewage Possibility" which was published in the Official Gazette dated 19.03.1971 and numbered 13783, the domestic waste will be collected in the septic tank without any leak during the construction period and at certain intervals it will be removed. It is provided in the Annex-21 that Aydın Metropolitan Municipality will remove this tank with its special machine.

The works to be carried out in all phases of the project shall be carried out in accordance with the provisions of the "Water Pollution Control Directive" (and all amendments made in the Directive), which was published in the Official Gazette dated 31.12.2004 and numbered 25687. The letter on the provision of water for use by Aydın Metropolitan Municipality is presented in Annex-22.

Possible Environmental Impact of the Project during the Operation and the Measures to be Taken;

Within the scope of binary system, the fluid coming from production wells will first be separated into steam and liquid phases in the separators. Then, the vapour and liquid phases are allocated to the evaporator where the fluid will be sent to secondary process and this liquid will turn into steam without getting physically involved increasing the temperature of the fluid.

The secondary work fluid converted to steam will be sent to the turbine and energy will be generated with the help of the generator connected to the turbine. The secondary fluid in the exhaust vapour coming out of the turbine will be absorbed in the air-cooled condenser and cooled and sent to the front heater via the cycle pump.

In the preheater, the first fluid that has lost some heat in the evaporator and the secondary fluid that is exchanging heat will be brought to a temperature close to the boiling temperature and sent to the evaporator.

Geothermal fluid that is sent to the pre-heater will be sent to reengineering wells after bringing the secondary work fluid to a temperature close to boiling temperature.

The most important factor determining the efficiency and life of the geothermal resource, and therefore the power plant, is the supply of the geothermal fluid to be used in the plant at a certain level and quantity of the flow of plant. For this reason, “reinjection” will be applied to prevent reservoir reduction in geothermal wells that feed the plant. Thus, the pressure drop and heat loss caused by the decrease of the reserve will be prevented. The facility will not operate until the reengineering process is activated. Both during the production stage and during reinjection works, fresh water aquifers will not be damaged.

It is estimated that the economic life of the said project will be approximately 30 years with the license modification procedures to be carried out within the scope of the project. During the economic life of the project, regular maintenance of the equipment must be done and replaced with a new one of the equipment which has a working life span. As long as the sufficiency and availability of geothermal potential in the region continues, the new drilling wells will be able to continue the plant site operation for many years.

The settlement closest to the project area is Germencik sub-province, about 630 m northwest. There is Reisköy District located 1.9 km southwest of the project site, Mesudiye District at 4.8 km northeast of the project, Akçeşme District at 6 km northeast of the project, Erbeyli District at 5,6 km east of the project and Sınırteke District at 5,4 km east of the project. The distance of the activity area to Aydın Provincial centre is about 19 km.

During the operation phase of the project, emissions from the cooling tower are expected.

Possible emissions from the operational phase of the project are CO₂, N₂, CH₄, NH₃, H₂S and H₂ gases. CO₂, which is about 99% of the volume, is an important factor in comparison to other gases.

The maximum hourly value and KVD values obtained by modelling studies for H₂S emissions that are likely to occur from all facilities in the license area during the operation phase of the project provide the limit values (hourly and KVS) specified in SKHKKY Table 2.2.

When we look at the effect values of Air Quality obtained using the AERMOD model, it is estimated that the possible emissions from the project's operation phase will provide SKHKKY limit values and therefore the operation will not pose any danger to human health and environment. In the modelling study, it is assumed that all power plants are in operation and emission distribution within the framework of the current technologies, and the processes where H₂S treatment efficiency is higher with developing technologies are preferred and the amount of emissions is expected to decrease.

Within the scope of the project, it is aimed to keep the gas emissions from the facility at the limit values specified in the regulation on control of industrial air pollution. In this context, necessary analysis and measurements will be made to the measurement firms accredited by the Ministry of Environment and Urbanisation. If the measurement results exceed the limit values, potential technical units will be evaluated in order to reduce the gas emissions.

In order to eliminate the problems caused by the calcite layer which is likely to occur in the pipes to be used during the transportation of the geothermal fluid to the plant, chemical dosing tools for the mechanical cleaning of the pipes or giving a suitable inhibitor to the pipe at the beginning of each well will be used to prevent other possible problems. The system to be installed in each operating well will prevent corrosion in pipes and contact surfaces and prevent operating problems.

It takes about two months to complete a well within the scope of drilling works. Rotary drilling technique is used in these works, three-stroke rotary drilling drill is provided to reach the source.

15 wells will be operated within the scope of the project for production and reengineering purposes. 10 production and 5 reengineering wells will be used within the planned activity. Only piping works will be performed in the existing wells and only in the newly opened wells will be carried out after drilling.

In relation to the drilling to be carried out, the drilling tower is placed on the determined area and this area is covered with bentonite. During the drilling, a mud pool is formed on the ground and the material formed during the drilling will be taken into the pool. These pools will be covered with impermeable membrane around wells for drilling mud.

During the opening of drilling wells, a small amount of excavation waste will be generated. The excavated soil will be collected at some point in the drilling area. After the drilling process is completed, some of the excavation will be used in the process of filling the mud pool. The excavation wastes will be disposed of by pouring into the excavation casting site of Germencik municipality or Aydın Metropolitan Municipality.

Within the scope of the project, approximately 1,500 tons/hour geothermal fluid will be used in the Efe-7 Geothermal Power Plant, which will be produced from 10 production wells. Then, the reengineering of used fluid with 5 wells will be done.

In the reinjection wells, a possible failure in the closed cycle of the source can be seen immediately in the Control Centre with the automation system and intervene here. For possible failures in the reinjection system, 9.000 m³ capacity storage pool in Efe-2 GPP campus will be used for the project. This pool will store 1,500 tons/hour geothermal resources for use in the system for about 6 hours. In case of prolonged failure, production wells are shut down via automation system and geothermal resource flow is stopped. Therefore, there will be no geothermal fluid transfer from the facility to the outside.

No blasting work will be done in the project area. Natural beds of existing streams determined within and around the project area will not be strictly interfered with the existing bed widths and applications that will prevent the free flow of water will not be made.

For the construction and maintenance of transportation roads, there will be no transition to a stream or construction of an art structure, and if such a situation is needed, the necessary permits will be taken separately. No changes will be made in the stream bed routes without the permission of DSI Regional Directorate.

During the construction and operation activities, the DSI administration will not be liable for any damages and related legal problems caused by floods and water pollution caused by improper practices.

Water will not be used without the permission of DSI from the irrigation canals around the project area in question. In addition, the plants that are operated by DSI (irrigation and drainage canals, creek beds, etc.) will not be discharged in any way.

In accordance with the provisions of the "Land Protection and Land Use Law" No. 5403, which came into force after being published in the Official Gazette No. 25880 dated July 19, 2005, the necessary permits will be obtained from Aydın Food, Agriculture and Husbandry Provincial Directorate and/or the Ministry of Food, Agriculture and Husbandry.

Within the scope of all works to be carried out in the field of the project "Waste Oil Control Directive" (amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812) entered into force by being published in the Official Gazette dated 30.07.2008 and numbered 26952 (amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812) provisions will be complied with.

Within the scope of the project, the maintenance and repairs to be done in a sealed area will be carried out, and during the work to be done in accordance with the provisions of the "Directive on Control of Soil Pollution and on Point-Sourced Contaminated Areas" (amended: OG-14.6.2012 - 28323, OG-11.07.2013-28704), published in the Official Gazette dated 08.06.2010 and numbered 26952.

The provisions of the "Waste Management Directive", which came into force after being published in the Official Gazette dated 02.04.2015 and numbered 29314, will be complied with for potentially hazardous wastes in all phases of the project.

As a conclusion;

Potential environmental impacts and control measures to be taken against these impacts have been assessed in the relevant sections of the EIA report and all commitments given in the report will be complied with during the operation phase of the project.

The laws and regulations to be followed during the construction and operation process of the project are listed below:

- ✓ Law on the amendment of Environmental Law No. 2872 and Environmental Law No. 5491
- ✓ Occupational Health and Safety Law No. 6331
- ✓ Forest Law no. 6831
- ✓ 4342 Law of Pasture
- ✓ Olive Plantation Law No. 4086
- ✓ Law No. 5403 on Land Protection and Land Use
- ✓ Fishing Law No. 1380 and the Directive
- ✓ Directive on Occupational Health and Safety (OG no: 14765 dated 11.01.1974))
- ✓ Directive on Health and Safety in Construction Works (OG no: 25325 dated

23.12.2003)

- ✓ Directive on the Assessment and Management of Environmental Noise (OG no: 27601 dated 04.06.2010) (amended: OG-27.4.2011-27917)
- ✓ Implementing Directive on Waters for Human Consumption (OG on 31.7.2009-27305, OG on 7.3.2013-28580, OG on 11.4.2014 - 28969)
- ✓ Directive on Control of Excavation Soil, Construction and Debris Wastes (OG no. 25406 dated 18.03.2004) (amending Directive No. 27533 dated 26.03.2010)
- ✓ Directive on Control of Industrial Air Pollution (RG no: 27277 dated 03.07.2009) and amending Directives
- ✓ Air Quality Assessment and Management Directive (06.06.2008 dated 26898 Nr.)
- ✓ Changes in the Water Pollution Control Directive (OG no: 25687 dated 31.12.2004) and all amending Directives
- ✓ Directive on Protection of Wetlands (RG no: 25818 dated 17.05.2005) (Directive no: 27684 dated 26.08.2010))
- ✓ Directive on Control of Packaging Waste (OG dated 24.08.2011, no: 28035)
- ✓ Directive amending the Directive on Waste Oil Control (OG no: 26952 dated 30.07.2008) (amendment: OG-31.07.2009-27305, OG - 30.03.2010-27357, OG-05.11.2013-28812)
- ✓ Directive on Control of Vegetable Waste Oil (OG no 257991 dated April 19, 2005) (Directive no:27537, dated 30.03.2010))
- ✓ Directive on Control of Soil Pollution and on Point-Borne Contaminated Areas (OG no: 27605 dated 08.06.2010) (amendment: OG - 14.6.2012-28323, OG-11.7.2013-28704)
- ✓ Directive on Control of Expired Tires (amended: OG-30.03.2010-27537, OG-10.11.2013-28817, OG - 11.3.2015-29292)
- ✓ Directive on Exhaust Gas Emission Control and Quality of Petrol and Diesel (OG dated 30.11.2013 and numbered 28837)
- ✓ Directive on Control of Waste Batteries and Accumulators and amending Directive (dated 31.08.2004 and 25569 numbered OG) (changed: OG on 03.03.2005/25744, OG on 30.03.2010/27537, OG on 5.11.2013-28812, OG on 23.12.2014-29214)
- ✓ Directive on Pits to be Constructed in Places without Sewage Possibility (19.03.1971 dated 13783 numbered OG)
- ✓ Environmental Permission and License Directive (OG no. 29115 dated 10.09.2014) (OG no. 29117 dated 12.09.2014))

- ✓ Directive on Buildings to be Constructed in Disaster Zones (OG on 14.07.2007 dated 26582 Nr.)
- ✓ 5403 Land Protection and Land Use Law, Regulation and Directive
- ✓ Waste Management Directive (OG dated 02.04.2015 and numbered 29314))
- ✓ Directive on the Regular Storage of Waste (OG dated 26.03.2010 and numbered 27533) (amendment: OG on 11.03.2015-2292929)