



GÜRMAT ELEKTRİK ÜRETİM A.Ş.

(GÜRMAT ELECTRIC GENERATION CO. INC.)



AYDIN PROVINCE, GERMENCİK DISTRICT, ÖMERBEYLİ
QUARTER IZGAR LOCALITY, BLOCK 115, PLOTS 5, 6, AND 7

EFE-8 GEOTHERMAL POWER PLANT (2*25=50 MWe)

EIA REPORT



FINAL EIA REPORT

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Project Name	EFE-8 GEOTHERMAL POWER PLANT (2*25=50 MWe)
Project Cost	TRY 125,000,000
Full address of the location selected for the project (Province,	Aydın Province, Germencik District, Ömerbeyli Quarter, Izgar Locality, Block 115, Plots 5, 6, and 7
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

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-8 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 36,705.33-m² area composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm.

Plots 5, 6, and 7 intended to be used for Efe-8 Geothermal Power Plant are at the south of geothermal power plants, which belong to Gürmat Elektrik Üretim A.Ş. and are currently being operated, whereas the pool, switchyard, and workshop units belonging to the existing plants are 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 (reinjection) to underground after energy generation.

The 50-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 by means of the switchyard of Efeler GPP substation. Approximately 400,000,000 kWh of annual generation is planned under the Efe-8 GPP project.

The geothermal fluid to be used will be conveyed 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.

400 and 12 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 2,000 m northwest. The locations of other residential areas are as follows: Ömerbeyli Quarter is 2.4 km northeast of the project site, Akçeşme Quarter is 3.3 km northeast, Erbeyli Quarter is 2.5 km east, Sınırteke Quarter is 2.1 km southeast, and Reisköy Quarter is 4.25 km southwest. The distance of the activity area to Aydın city center is approximately 18 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-8 Geothermal Power Plant with a total installed power of $2 \times 25 = 50$ MWm / $2 \times 25 = 50$ MWe 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 İzgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province.

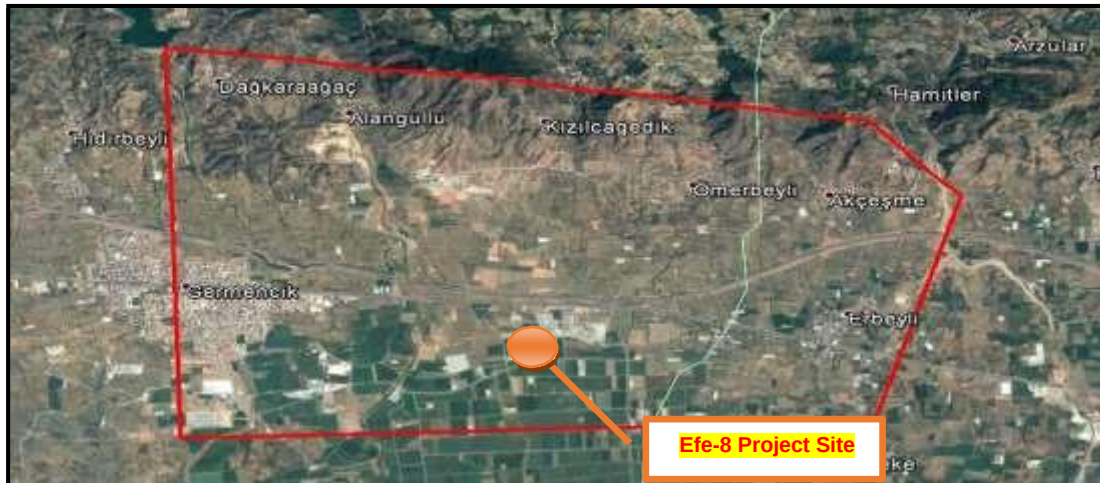
Approximately 400,000,000 kWh of annual generation is planned under the Efe-8 GPP project. It is calculated that Efe-8 Geothermal Power Plant with 50 MW installed power can meet all electricity needs of 165,000 households in average per month (Average monthly electricity generation for households is assumed to be 200 kWh).

The plant will use the geothermal source located in the investor firm's licensed field within the boundaries of Ömerbeyli Village of 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".

**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 36,705.33-m² area composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm (see Annex-10).

Necessary correspondences were made with the General Directorate of TEİAŞ to provide the connection of electrical energy to be generated within the scope of Efe-8 Geothermal Power Plant Project to the national interconnected system. In their letter E.355025 dated 06.10.2016 as a result of this process, the General Directorate of TEİAŞ has stated that it would be appropriate to connect Efe-8 GPP, the installed power of which is intended to be 2*25=50 MWe, to the national system through "the switchyard of Efeler GPP substation as 154 kV (154 kV Germencik substation)" (see Annex-11).

The construction work within the scope of the Efe-8 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.

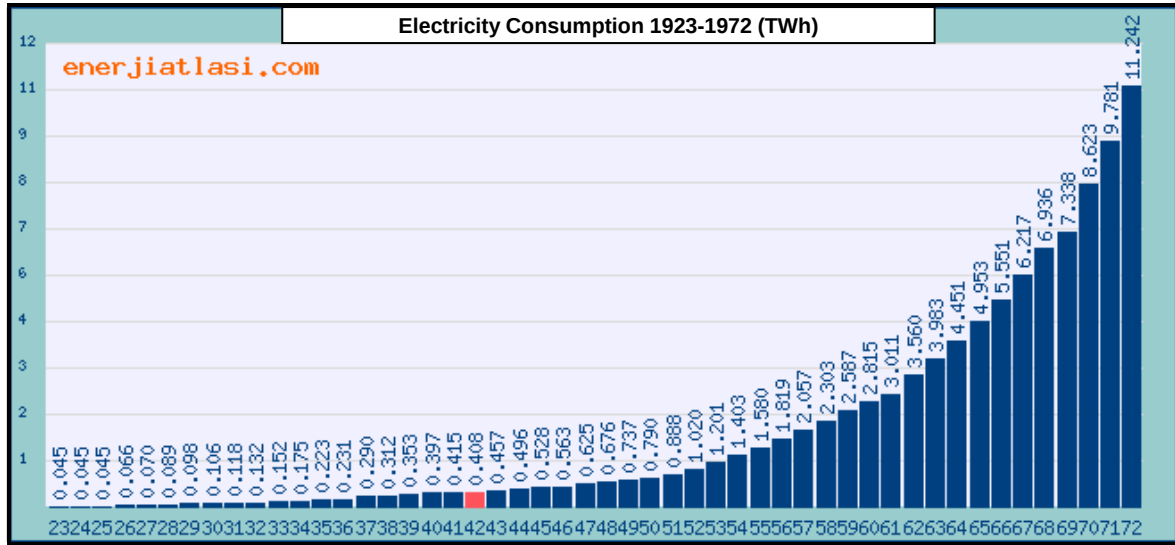


Figure 2. Electricity consumption 1923-1972

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

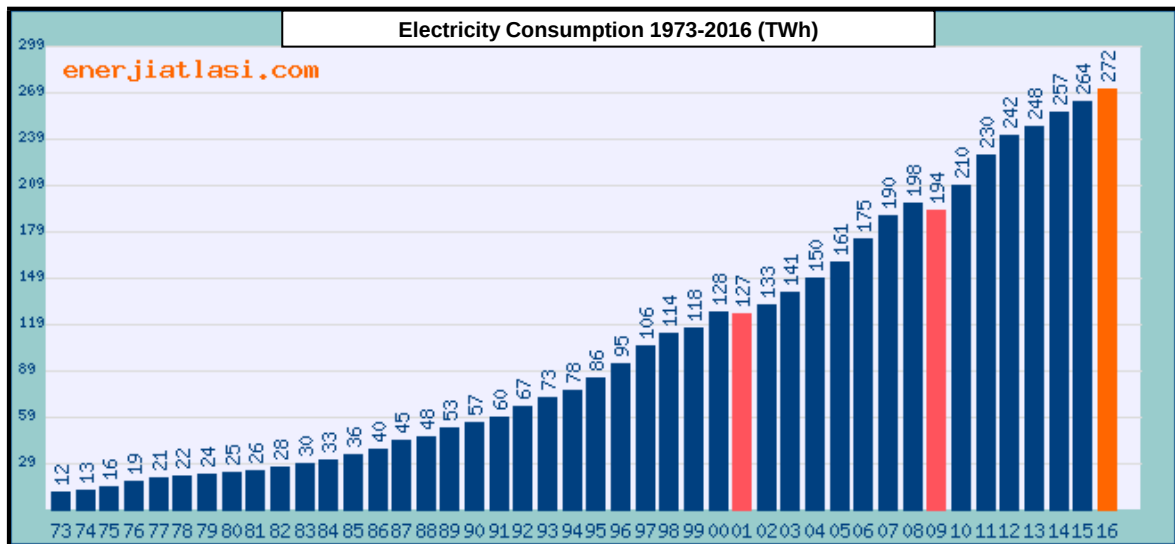


Figure 3. Electricity consumption 1973-2016

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 led 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.

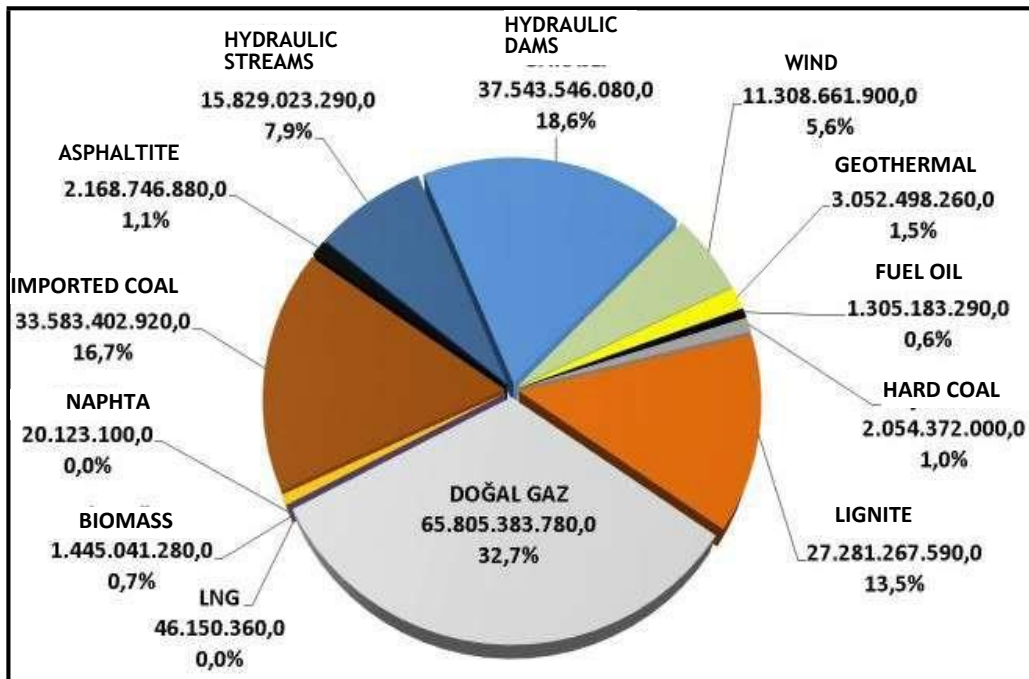


Figure 5. Electricity Generation in Turkey (as of October 2016)

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-8 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-8 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-8 Geothermal Power Plant with a total installed power of $2 \times 25 = 50$ MWm / $2 \times 25 = 50$ MWe 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 Izgar Locality of Ömerbeyli 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.
- The application drawing and 1:5,000- and 1:1,000-scale approved base maps of the project site are given in Annex-15.

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 36,705.33-m² area composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli 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.

There are existing roads around the project site. The site is accessed through the İzmir-Aydın highway (D-550), 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 2,000 m northwest. The locations of other residential areas are as follows: Ömerbeyli Quarter is 2.4 km northeast of the project site, Akçeşme Quarter is 3.3 km northeast, Erbeyli Quarter is 2.5 km east, Sınırtıke Quarter is 2.1 km southeast, and Reisköy Quarter is 4.25 southwest.

The distance of the activity area to Aydın city center is approximately 18 km.



Figure 6. Satellite Image Showing the Project Site 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 is continuing in parallel with the EIA process.

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" and "irrigation 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-8 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	Latitu	Longitu
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 Scale factor : 6 degree		Coordinate order : Latitude, Longitude Datum : WGS-84 Type : GEOGRAPHICAL Segment central meridian: 27 Zone : 35 Scale factor : -----	
	Y	X	Latitu	Longitu
1	556570.777	4190966.607	37.86274620	27.64265799
2	556564.061	4191148.541	37.86438629	27.64259588
3	556565.493	4191149.863	37.86439811	27.64261226
4	556568.712	4191152.557	37.86442219	27.64264907
5	556572.060	4191155.092	37.86444483	27.64268733
6	556575.527	4191157.459	37.86446595	27.64272693
7	556579.106	4191159.655	37.86448552	27.64276779
8	556582.788	4191161.673	37.86450348	27.64280980
9	556586.564	4191163.509	37.86451979	27.64285287
10	556590.487	4191165.226	37.86453502	27.64289760
11	556601.675	4191169.648	37.86457418	27.64302514
12	556612.916	4191174.029	37.86461297	27.64315327
13	556631.549	4191181.652	37.86468051	27.64336569
14	556646.736	4191187.610	37.86473326	27.64353881
15	556724.568	4191218.636	37.86500805	27.64442605
16	556734.254	4190956.214	37.86264237	27.64451557
17	556655.091	4190961.247	37.86269265	27.64361605
18	556609.260	4190964.160	37.86272175	27.64309527

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 5. Coordinates of Power Generation and Reinjection Wells

EFE-8			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 : -----	
	Order	Well name	Y	X	Latitude	Longitude
Production wells	1	OB-30A	557208	4191387	37.866495220	27.649935160
	2	OB-30B	557200	4191388	37.866504730	27.649844290
	3	OB-88	558270	4191178	37.864544350	27.661991620
	4	OB-88A	558262	4191178	37.864544860	27.661900670
	5	OB-88B	558254	4191178	37.864545380	27.661809730
	6	OB-95A	558922	4190909	37.862078100	27.669381720
	7	OB-95B	558930	4190908	37.862068570	27.669472580
	8	OB-32	557497	4190570	37.859113850	27.653155660
	9	OB-33	557579	4190936	37.862407240	27.654116940
Reinjection wells	1	OB-21	559335	4192851	37.879553430	27.674236070
	2	OB-21A	559334	4192835	37.879409300	27.674223390
	3	OB-21B	559334	4192835	37.879409300	27.674223390
	4	OB -21C	559334	4192827	37.879337200	27.674222730
	5	OB -23	560704	4192736	37.878426830	27.689792490
	6	OB -23A	560704	4192736	37.878426830	27.689792490
	7	OB -23B	560704	4192736	37.878426830	27.689792490
	8	OB -23C	560704	4192736	37.878426830	27.689792490

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-8 Geothermal Power Plant" on an area, the total surface area of which is 36,705.33-m², composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli 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 6. Surface Area Information

Block/Plot no	Surface
Block 115 / Plot 5	7,507.20
Block 115 / Plot 6	9,880.98
Block 115 / Plot 7	19,317.15
Total	36,705.33

The locations of the units planned within the scope of Efe-8 Geothermal Power Plant Project are indicated on the Layout Plan in Annex-6.

The project site is located approximately 18 km west of Aydın city center. The air distance of the plant to Germencik district center is 2 km.

The locations of other residential areas are as follows: Ömerbeyli Quarter is 2.4 km northeast of the plant, Akçeşme Quarter is 3.3 km northeast, Erbeyli Quarter is 2.5 km east, Sınırteke Quarter is 2.1 km southeast, and Reisköy Quarter is 4.25 southwest. 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 7. Details regarding the Other Residential Areas around the Project Site

Residential unit	Direction	Distance (m)
Germencik District		
Germencik District	Northwest	2,000
Ömerbeyli Quarter	Northeast	2,400
Reisköy Quarter	Southwest	4,250
İncirliova District		
Sınırteke Quarter	Southeast	2,100
Akçeşme Quarter	Northwest	3,300
Erbeyli Quarter	East	2,500

The satellite image showing locations of the residential areas with respect to "Efe-8 Geothermal Power Plant" (EIA area) is given in Figure 7.

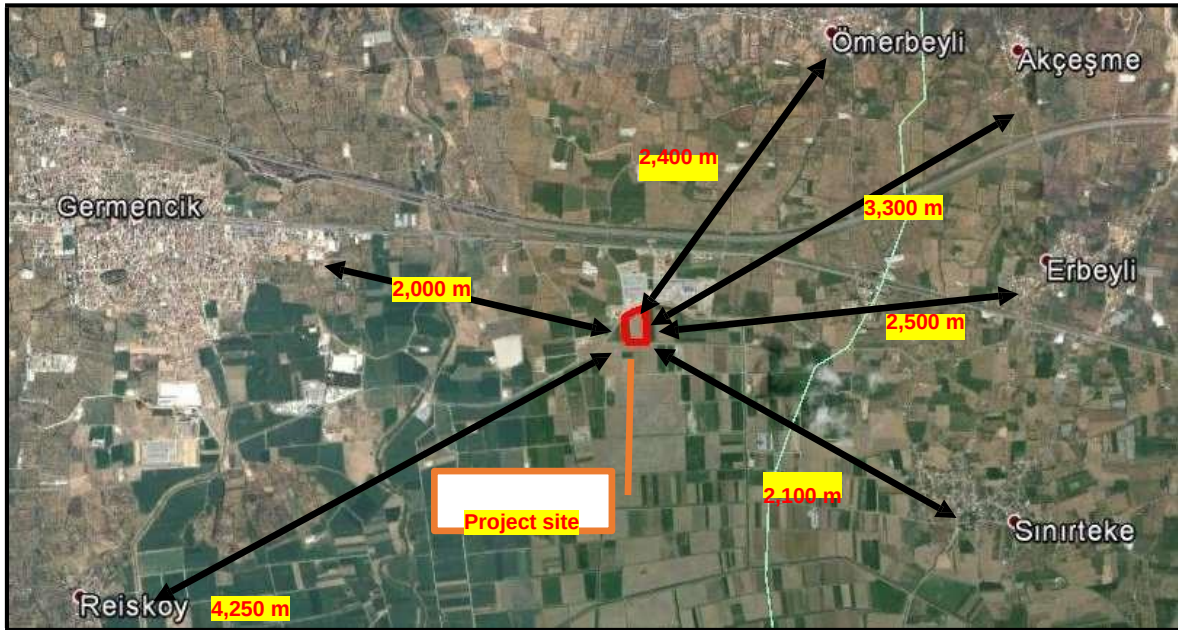


Figure 7. Satellite Image Showing the Project Site and the Distances of the Residential Areas Closest to the Project Site

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.



Figure 8. Topographic Map Showing the Project Site

The satellite image of the plots 5, 6, and 7 of block 115, the total surface area of which is 36,705.33 m², is given in Figure 9.



Figure 9. Block 115, Plots 5, 6, and 7

The plots intended to be used for Efe-8 Geothermal Power Plant are at the south of field containing Efe-1-3-4 GPP, which is currently being operated.



Figure 10. Position of Efe-8 project site according to Efe 1, 3, and 4

The pond, switchyard and workshop will be used jointly with the existing plants within the scope of Efe-8 Geothermal Power Plant project.

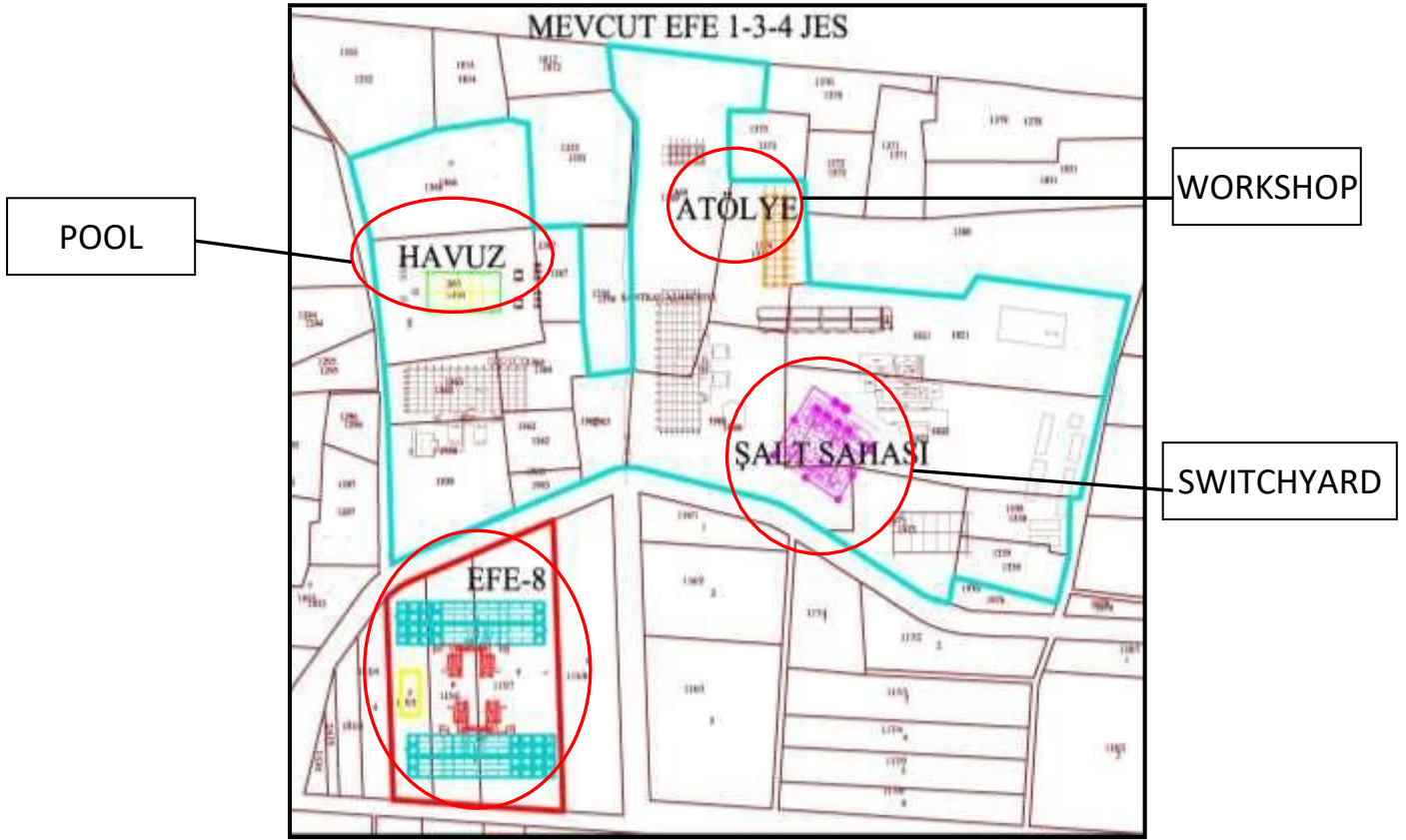


Figure 11. Intended Joint Uses

The geothermal fluid to be produced at a rate about 2,500 tons/hour by 9 production wells within the scope of the project is planned to be used by Efe-8 Geothermal Power Plant. The geothermal source to be used by the plant will be re-pumped to underground by means of 8 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 50-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 by means of the switchyard of Efeler GPP substation. Approximately 400,000,000 kWh of annual generation is planned under the Efe-8 GPP project.

The geothermal fluid to be used will be conveyed 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-8 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 8.

Table 8. Project Details

License details	
License No	J-553
Plant's surface area	36,705.33 square meter
Technology	Binary System
Installed Power	2 x 25 = 50 Mwe
Point of connection to power transmission line	Switchyard of the substation of Efeler GPP, 154 kV (154 kV Germencik substation)
Electricity generation amount	400 GWh/year
Production wells	9 pieces
Reinjection wells	8 pieces
Maximum geothermal fluid amount	2,500 tons/hour
Cooling tower	104 Fan and Hood Sets (air-cooled)
Number of storage pools	1 pool
Storage capacity of storage pool	3 hours
Volume of storage pool	7,500 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 power geothermal process in geothermal power plants, but it is also an important practice for operating geothermal plants with high yield, although it is thought to cause an additional cost. Power plants with no reinjection can use only a small portion of the geothermal energy due to pressure drop and heat loss arising from reduction of geothermal reserves.

The geothermal fluid which losses its temperature and pressure by separating from its steam in advance of the steam turbine will be pumped underground by the reinjection method while 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 works in accordance with a conventional Rankine cycle. Binary systems with a suitable working fluid can operate at inlet temperatures in the range of 80-170 °C.²

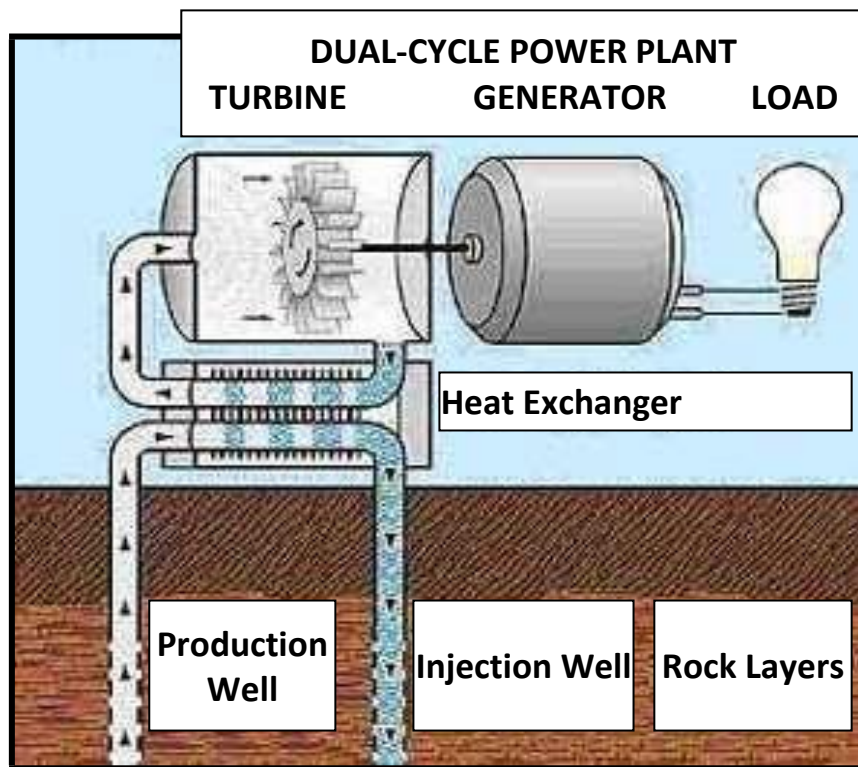


Figure 12. Schematic view of the binary system

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

Turbines, generator

High-pressure secondary work fluid in the gas phase arriving in the turbines enters the turbine to turn the turbine blades and the kinetic energy produced in this way is converted into electrical energy in the generator. System control will be ensured by equipping every turbine inlet with control valves. The cooling water system that provides cooling of the bearings and oil in the system will provide cooling of the bearing components and oils of the turbine and generator.

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

Production and injection system

In this system, the geothermal fluid is collected from the production wells and transported to the separation station. The gas and liquid geothermal fluid separated here from each other is sent to the evaporator.

The secondary work fluid becomes hot in the evaporator. The liquid geothermal fluid from the evaporator is sent to the preheaters, so that the secondary work fluid is passed to the gas phase. The liquid geothermal fluid from the preheater conveyed to injection wells and reinjected to the reservoir by means of reinjection pumps.

Uncondensed gas discharge system

Uncondensed gases from the evaporator are removed from the system by means of a silencer on the air-cooled condenser.

Air-cooled condenser

This system is used to cool the secondary work fluid from the turbine and convert it into a liquid phase.

Circulation pump and recuperator

The secondary work fluid in gas phase exiting from the air-cooled condenser is directed to the recuperator by means of circulating pumps, and it is loaded with the heat energy of the secondary work fluid in gas phase directed to the air-cooled condenser in the recuperator and continues its movement towards the pre-heater.

Auxiliary systems

In addition to the abovementioned main systems, some auxiliary systems have been designed to provide the necessary system for supplying the required running water for the plant site and the fire protection of the plant equipment. It consists of running water supply, fire response systems, and a fire water storage tank.

Instrument control system of the power plant

The plant control and protection system, which is established for the purpose of protection, automation and control room of the plant, is a system consisting of monitoring instruments and control valves and panels.

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

These systems consist of tubular materials and brackets used in the construction of geothermal wells, wellhead main valves to be used at wellheads to control and regulate the flow, inhibitor systems preventing in-pipe incrustation, check valves, and silencers and flumes used for test procedures.

Machinery and Equipment To Be Employed Within The Scope of The Project

The operation phase of Efe-8 GPP project will be as follows: a two-phase fluid is supplied from production wells by means of collection lines; the fluid is separated in pressure separators and the steam obtained from this separation drives the turbine and creates mechanical energy by means of the resulting rotational motion; this mechanical energy is transformed into electrical energy by generators and dispatched to the switchyard and transmission lines therefrom.

The location of production wells, reinjection wells and plant will be different, so different machinery and equipment will be used will be used in each unit within the scope of the project. However, the plots intended to be used for Efe-8 Geothermal Power Plant are at the south of field containing Efe-1-3-4 GPP, which is currently being operated, and the pool, switchyard and workshop will be used jointly.

The machinery and equipment intended to be used in the wellhead facilities of production wells are listed below:

- Inhibitor dosing system
- Wellhead check valves
- Separator
- Balancing tank
- Filters
- Pumps
- Measuring equipment
- Manual valves
- Safety equipment
- Compressor
- Driver panels
- Automation panel

Machinery and equipment to be used in the wellhead facilities of reinjection wells:

- Reinjection pumps
- Manual valves and check valves
- Measuring equipment
- Safety equipment
- Driver panels
- Automation panels
- Frequency control equipment panel
- Breaker cells
- Transformer

Machinery and equipment to be used in the plant:

- Exchangers
- Recuperators
- Turbine
- Transformer

The flow diagram of the process intended to be implemented within the scope of Efe-8 Geothermal Power Plant project is given in Figure 13 and Figure 14.

The main output of EFE-8 GPP project is the electrical energy to be generated. The electrical energy to be generated within the scope of the intended operation will be approximately 400,000,000 kWh/year. The power generation capacity of the intended project is detailed in Table 9.

ANNUAL POWER GENERATION CALCULATION FOR EFE-8 50,00 MW BINARY POWER PLANT

ANNUAL POWER GENERATION CALCULATION FOR EFE-8 50,00 MW BINARY POWER PLANT														
		January	February	March	April	May	June	July	August	September	October	November	December	
Average regional 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	55.91	55.91	55.49	53.82	52.25	45.46	44.41	43.37	49.64	53.56	55.65	55.28	
Total consumption of Organic Rankin Cycle	MW	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	
Total of other loads (BTP + Reinj.)	MW	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	
Transmission line losses	MW	1.40	1.40	1.39	1.35	1.31	1.14	1.11	1.08	1.24	1.34	1.39	1.38	
Net power	MW	47.87	47.87	47.46	45.83	44.30	37.68	36.66	35.64	41.76	45.58	47.62	47.26	
Days		31	28	31	30	31	31	30	31	30	31	30	31	
Hours		744	672	744	720	744	744	720	744	720	744	720	744	
Total generation	MWh	41,595	37,570	41,284	38,749	38,874	33,820	31,977	32,265	35,739	39,846	40,065	41,129	
Net generation	MWh	35,615	32,169	35,312	32,999	32,962	28,035	26,397	26,519	30,065	33,910	34,283	35,160	
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			
Annual net generation	MWh	374,253	371,247	368,241	361,508	357,824	370,044	367,038	364,032	357,342	357,420			
Notes:														
1 - The total of other loads includes the consumption of reinjection pumps, transfer pump and other equipment.														
2 - 2-week halts in the 5th and 10th years for overhaul in the plants is taken into account.														
3 - Annual yield loss is considered as 0.8%														
4 - TEİAŞ transmission loss is assumed to be 2.5%.														
5- 50-MW generation value of the generation license is has been taken into account in planning.														

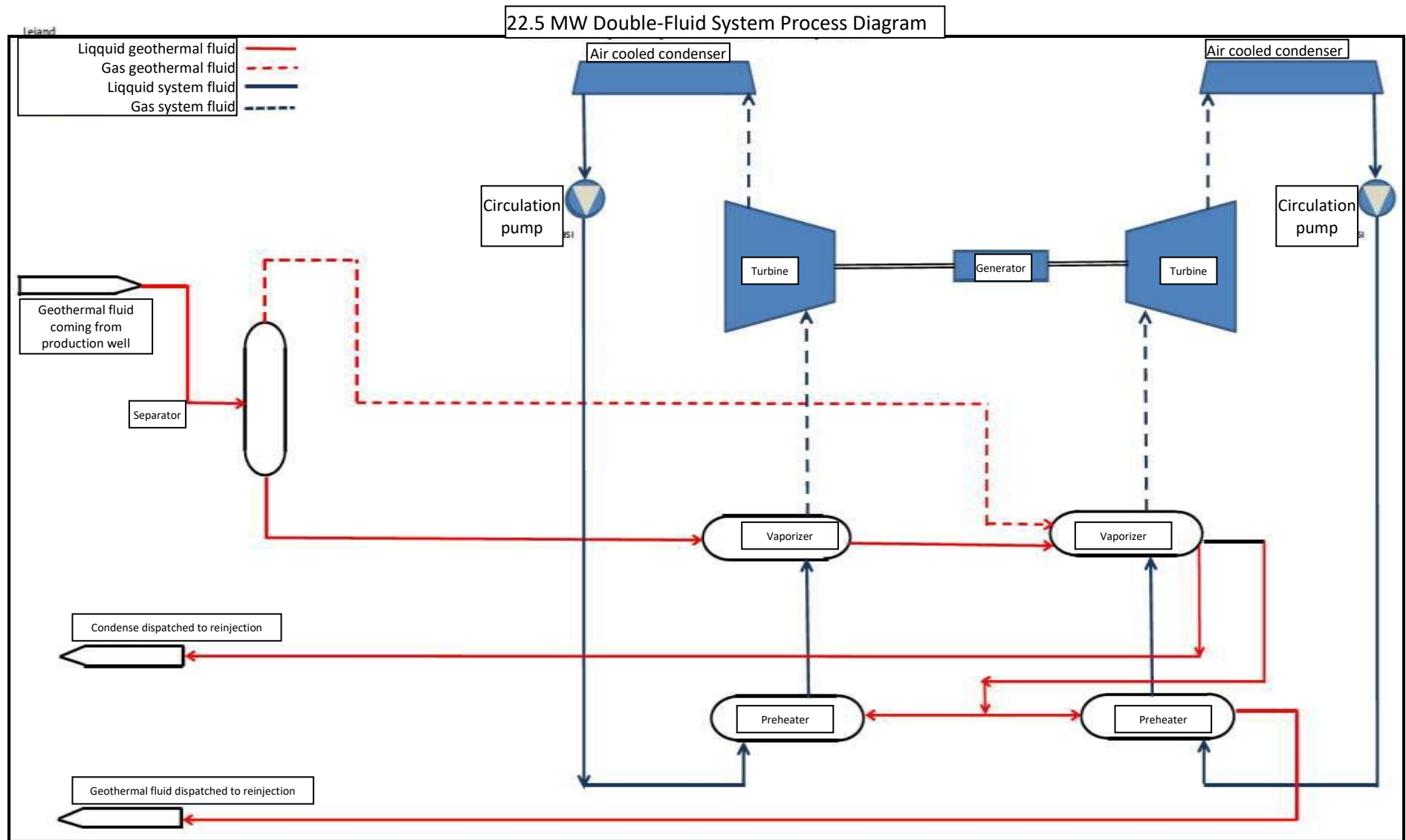


Figure 13. Process flow chart

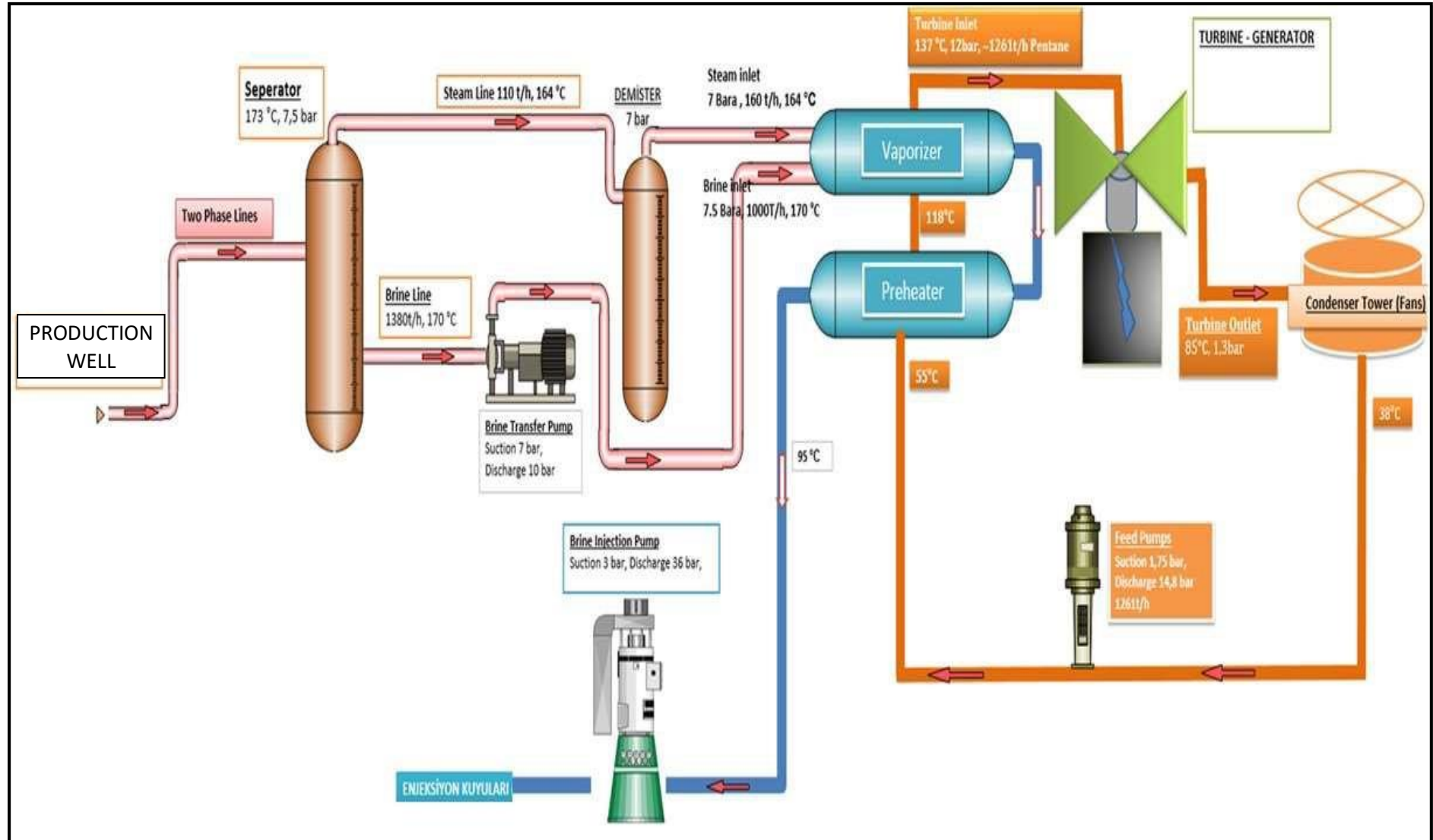


Figure 14. Schematic view of the process flow

I.5. Economic characteristics of the project (relevant investment schedule, sources of finance, where from to obtain these sources, workflow diagram or timing table, cost-benefit analysis)

The intended investment schedule encompasses the necessary expenditures including project design, research, construction, and production and reinjection wells from the first phase of the project to the operation phase.

The total investment amount of the Efe-8 Geothermal Power Plant Project is TRY 125,000,000.

Approximately 20% of the financial resources required for the Efe-8 Geothermal Power Plant project will be covered by the owner's equity while the remaining 80% will be covered by 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 national generation capacity will serve the interests of the domestic industry. It is aimed with the project to contribute to the national electricity generation even though partially.

The intended timetable is presented in Table 10.

Table 10. Timetable

Steps	MONTHS																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1- Pre-construction period																								
Engineering calculations, project designing																								
Conducting of permission processes under the																								
2- Construction phase																								
Procurement, purchasing																								
Land preparation, plant construction																								
Installation of mechanical																								
Commissioning of the plant																								

Cost-benefit analysis

Cost-benefit analysis is an important indicator of whether a project is economically viable. Therefore, it would be better to analyze the costs and benefits of the Efe-8 Geothermal Power Plant separately for the investing company, the region where the project will take place, and our country.

Benefit-cost analysis for the investing company

The assumptions predicated on for the calculations in terms of economic evaluation of the intended capacity increase project are as follows.

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

The payback period of the intended project is approximately 5-7 years after the commissioning according to economic analyses and financial assessment based on these assumptions. Therefore, the project is an economical investment for the national economy and the investing company.

Cost-benefit analysis for the region and the country

There is an increasing national energy demand in parallel with the rapidly growing industry and economy. It is obvious that any economical investment in the national generation capacity would serve the interests of the domestic investors and our people.

The national energy policy is to provide reliable, good quality and clean energy to all users at the right time in order to support economic and social development. Therefore, it is expected that all domestic and imported energy resources are used and all domestic & foreign and public & private investment and finance facilities are use in order to supply energy needed to meet energy demands in an economical and reliable manner.

Continuity and reliability in electricity generation would contribute to national development. The EFE-8 Geothermal Power Plant project is expected to provide economic development and employment opportunities to the region. Labor, materials and services supplied locally during the construction and operation phases of the project would contribute to regional economy.

I.6. Other issues

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

CHAPTER II:

CURRENT ENVIRONMENTAL CHARACTERISTICS OF THE PROJECT SITE AND ITS SPHERE OF INFLUENCE

CHAPTER II: CURRENT ENVIRONMENTAL CHARACTERISTICS OF THE PROJECT SITE AND ITS SPHERE OF INFLUENCE

(In this section, the environmental aspects of the site selected for the project should be considered while the sphere of influence is considered. While the issues listed in this section are explained, the sources and entities, such as public organizations and institutions, research agencies, universities, or other similar entities, from which information is obtained are indicated in the notes section of the report or imprinted on the relevant maps, documents, etc. If the project owner wants to provide information based on his/her own investigations, a document shall be obtained for any information under the jurisdiction of a public organization or institution from the relevant public organization or institution verifying the accuracy of the information and it shall be added to this report.

II.1 Determination of the area to be influenced by the project (how and based on what the sphere of influence determined to be explained and the sphere of influence to be shown on map)

Efe-8 Geothermal Power Plant with a total installed power of $2 \times 25 = 50$ MWm / $2 \times 25 = 50$ MWe 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 Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province.

The fact that the energy source is a geothermal reservoir in a geothermal power plant project causes limitation of the alternatives to be evaluated. The selection of the boundaries of the field of activity has been 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. While determining the area to be affected by the project, environmental, economic and social factors should be evaluated together.

The technology to be used in the operational phase of the activity is a modern and applicable technology, which is still being applied in similar plants. Therefore, it is thought that the technology chosen for energy generation would provide optimum conditions. The technology of the project is capable of being compatible with efforts to minimize the potential environmental effects of the project.

The sphere of influence of the Efe-8 GPP project has been determined as 500 m from the perimeter of the plant area, whereas a satellite image showing the sphere of influence of the project is given in Figure 15. There is no residential area within this sphere of influence. The sphere of influence comprises agricultural lands and the existing geothermal power plant.

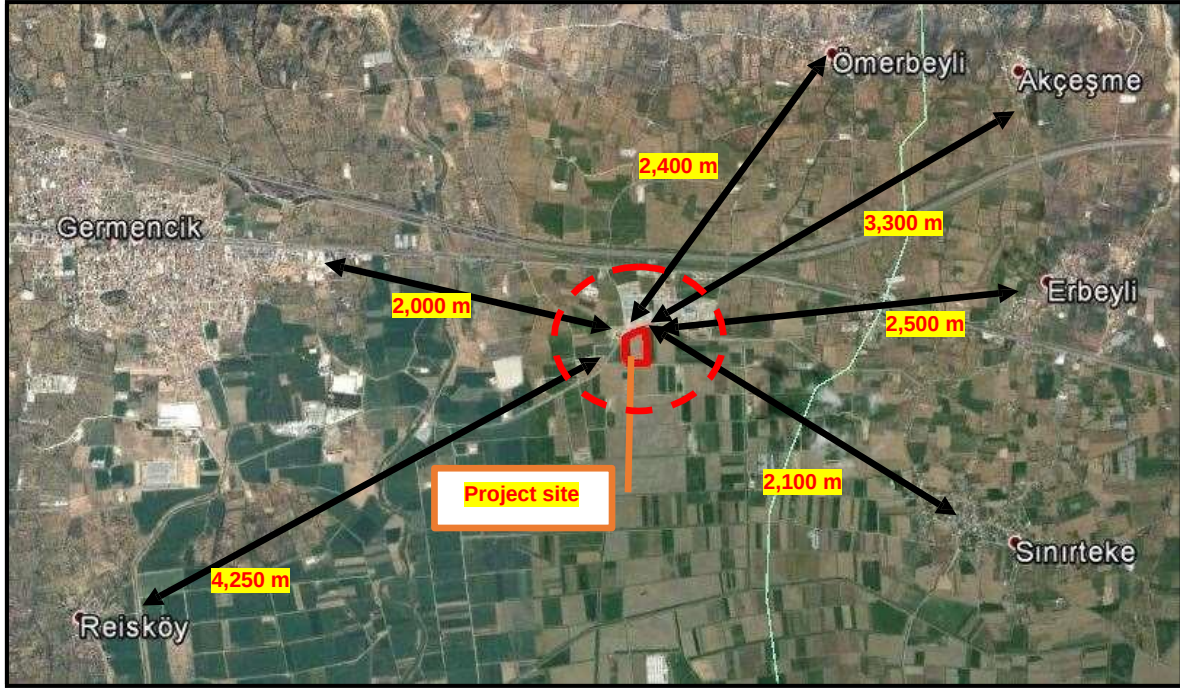


Figure 15. Satellite image showing the project site and the distances of the residential areas closest to the project site

The locations of the residential areas with respect to "Efe-8 Geothermal Power Plant" (EIA area) are given in the following table.

Table 11. Distance to the other residential areas around the project site

RESIDENTIAL UNIT	DIRECTION	DISTANCE (m)
Germencik District		
Germencik District	Northwest	2,000
Ömerbeyli Quarter	Northeast	2,400
Reisköy Quarter	Southwest	4,250
İncirliova District		
Sınırteke Quarter	Southeast	2,100
Akçeşme Quarter	Northwest	3,300
Erbeyli Quarter	East	2,500

The residential area closest to the project site is Germencik District which is located approximately 2 km northwest.

Environmental impacts of the production and reinjection wells will remain within the location areas and not overflow these areas. Therefore, the sphere of influence of each well to be used within the scope of the geothermal power plant has been foreseen as the boundaries of the location of that well.

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 impacts of the intended project on the aforementioned residential areas are discussed in the relevant sections of this EIA report.

II.1. Characteristics of physical and biological environment and use of natural resources within the sphere of influence

II.1.1. Meteorological and climatic characteristics (activity site's general climatic characteristics, temperature distribution, precipitation distribution, humidity distribution, evaporation, distribution of number of days (foggy, snowing, snow-covered, highest snow cover thickness, etc.), wind distribution, wind speed distribution, stormy days, strong windy days - information under this heading to include monthly-seasonal-annual distributions, meteorological data to belong set for many years to cover the last years),

General Climatic Conditions of the Region

Summers are hot and dry, whereas and winters are rainy and warm in Aydın province where the project takes place. The Büyük Menderes valley, like the other Aegean plains, is in the form of a groove opening towards the sea in the west. Hence, the warming effects of the sea and winds bringing precipitation can easily penetrate inlands.

Mediterranean climate type is widespread in general due to the impact of the Aegean Sea, which is a side extension of the Mediterranean, so summers are hot and dry, whereas and winters are rainy and warm. Almost all precipitation in the province is observed in the form of rain. Because of Aydın province's proximity to the Aegean Sea and the mountains being perpendicular to the sea, the Mediterranean temperate climate shows its effect to the inner part of the region. Although the climate does not differ significantly throughout the province, the further away from the coast, the more effective the continental climate.

In order to assess the meteorological conditions in the project site and surrounding areas, the results of continuous meteorological measurements conducted by the Turkish State Meteorological Service (TSMS) have been analyzed, where the optimal weather station results are presented by means of tables and graphics. In this context, data of Aydın weather station for the 1960-2015 period and the maximum precipitation values observed at standard times as well as the precipitation-intensity-duration and recurrence curves have been made use of, and the relevant documents are given in Annex-8.

Pressure Distribution

Considering the 1960-2015 data of Aydın weather station; the annual average pressure is 1006.9 hPa, annual maximum pressure is 1028.7 which is in January, and annual minimum pressure is 975.4 which is in January.

The pressure values are given in Table 12, whereas the graphical representation of pressure is in Figure 16.

Table 12. Pressure data from the Aydın Weather 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
Maximum pressure	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 weather station, 1960-2015 data

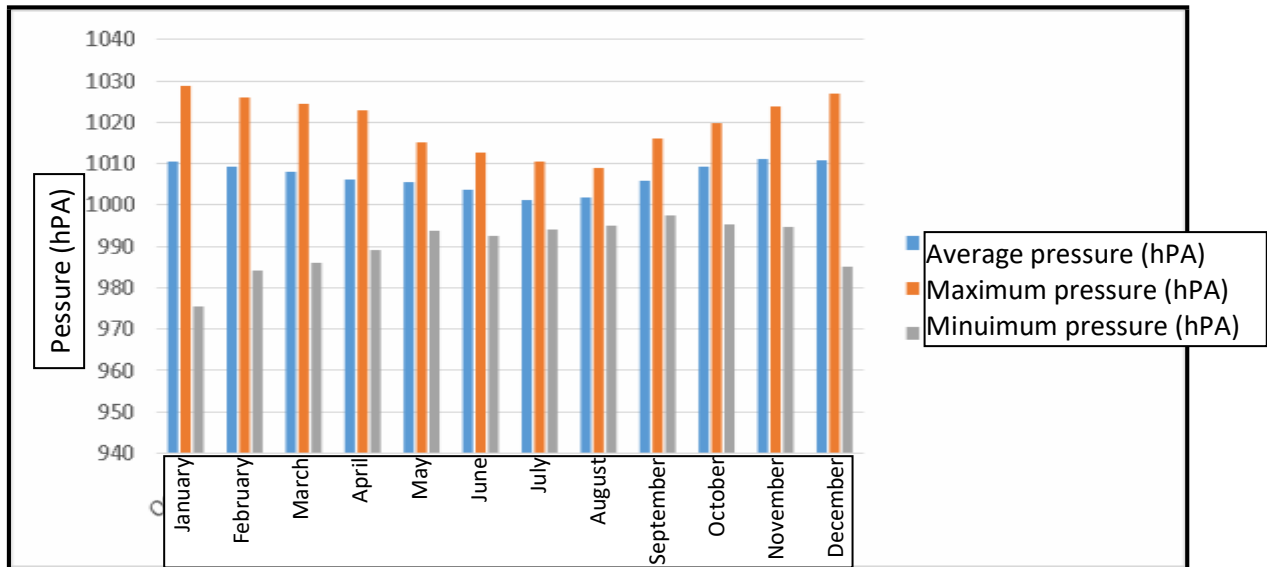


Figure 16. Graphic of pressure data from the Aydın Weather Station

Temperature Distribution

Considering the 1960-2015 data of Aydın Weather Station, the annual average temperature is 17.7 °C. According to observation results, the highest temperature was detected as 44.6 °C in July. And the lowest temperature was -7.6 °C, detected in January. The temperature values are given in Table 13, whereas the graphical representation of temperature is in Figure 17.

Table 13. Long-period 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 weather station, 1960-2015 data

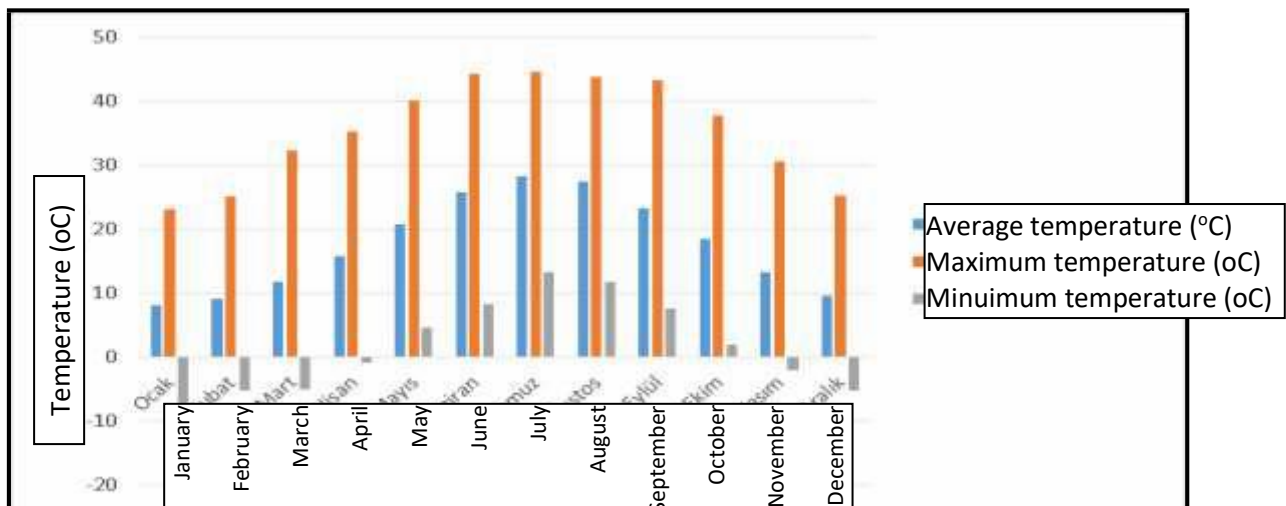


Figure 17. Monthly temperature distribution graphic from the Aydın Weather Station

Precipitation

Considering the 1960-2015 data of Aydın Weather Station, the annual total of precipitation is 634.5 mm.

The precipitation values of Aydın weather station are given in Table 14, whereas the graphical representation of precipitation is in Figure 18.

Table 14. Long-period precipitation data from the Aydın Weather Station

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 weather station, 1960-2015 data

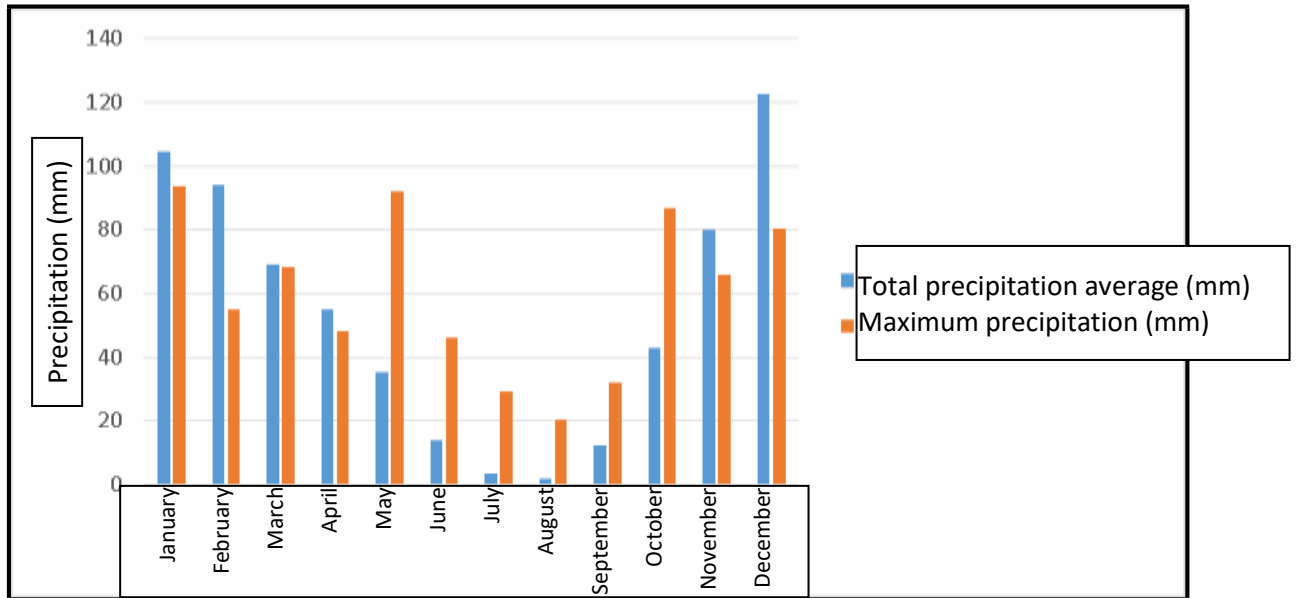


Figure 18. Graphic of precipitation data from the Aydın Weather Station

Humidity Distribution

According to 1960-2015 observation records of Aydın weather station, the annual average humidity is 61.9%. In addition, the lowest humidity was measured in July at 4%.

The 1960-2015 humidity values of Aydın weather station are given in Table 15, whereas the graphical representation of humidity is in Figure 19.

Table 15. Relative humidity values from the Aydın Weather 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 weather station, 1960-2015 data

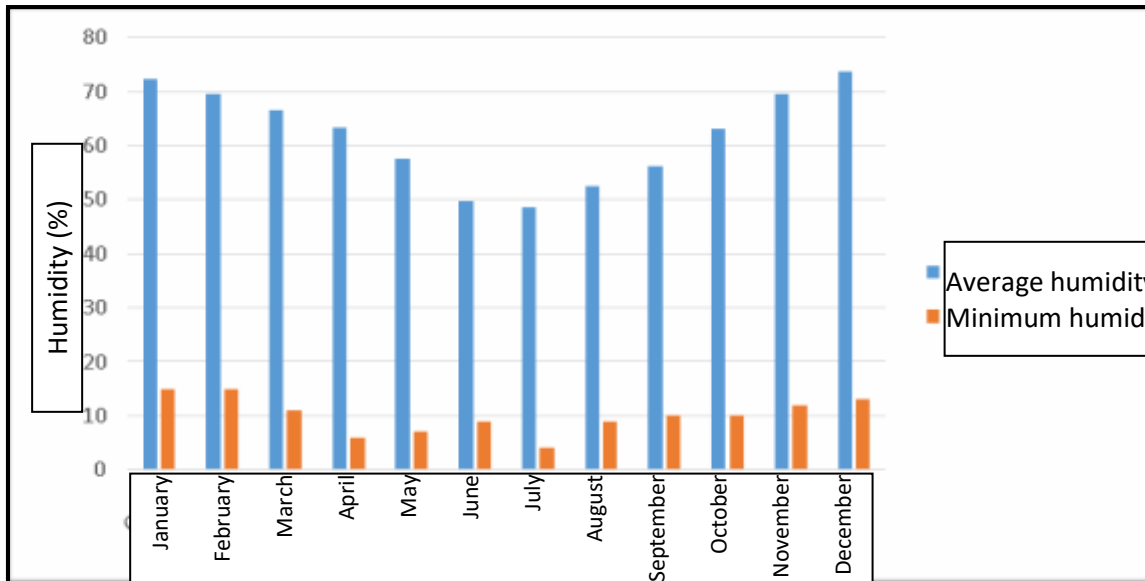


Figure 19. Graphic representation of minimum and maximum humidity data from the Aydın Weather Station

Number of Days

According to 1960-2015 observation records of Aydın weather station, the average number of snowy days per year is 10.4, the average number of foggy days per year is 36.4, the average number of hail days per year is 1.2, the average number of frosty days per year is 12, and the average number of thunderstorm days per year is 15.3.

The number-of-days data of Aydın weather station is given in Table 16, whereas the graphical representation thereof is in Figure 20 and 21.

Table 16. Number-of-days data from the Aydın Weather 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
Number of 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 frosty days	6.8	4.8	3	0.2						0.1	1.9	4.7	3.07
Average total number of thunderstorm 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 weather station, 1960-2015 data

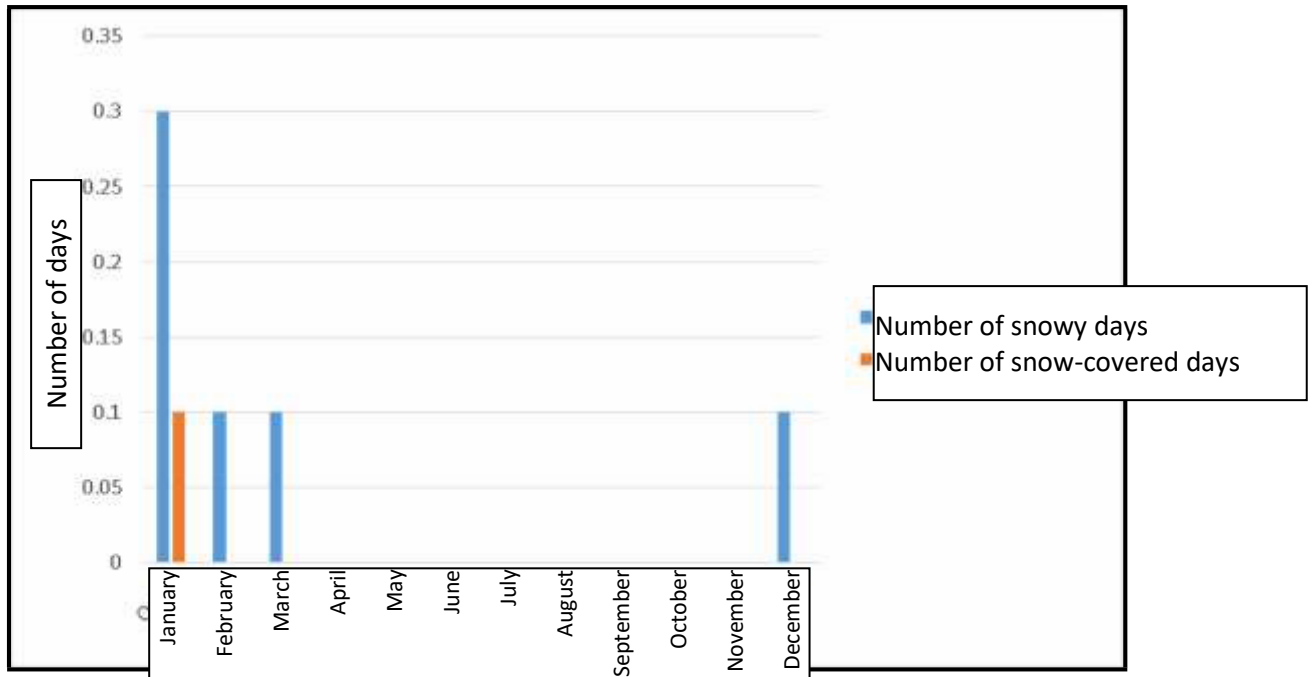


Figure 20. Graphic of the numbers of snowy and snow covered days from the Aydin Weather Station

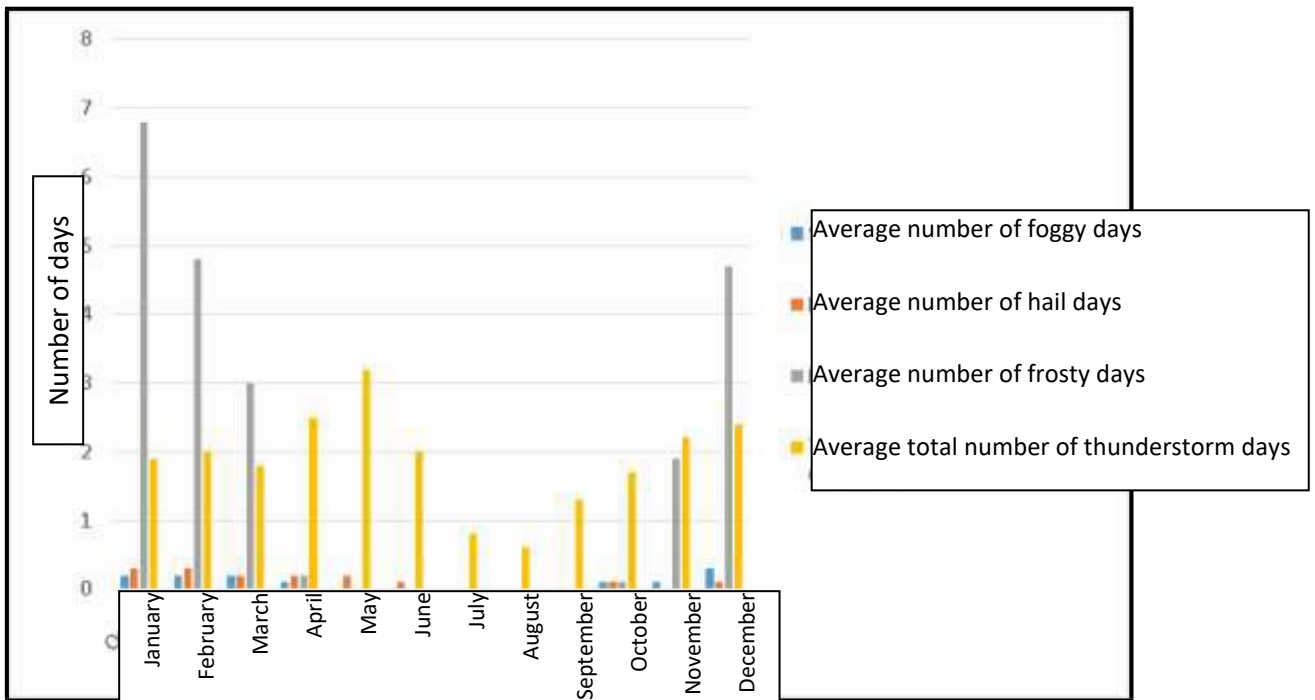


Figure 21. Graphic of the numbers of foggy, hail, and frosty days and the total number of thunderstorm days from the Aydin Weather Station

Maximum Snow Depth

According to 1960-2015 observation records of Aydin weather station, the annual maximum snow depth was 6 cm in January. The graphic illustrating the distribution by months is presented in Figure 22, whereas the values are given in Table 17.

Table 17. Maximum snow depth from the Aydın Weather Station (cm)

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Maximum snow depth (cm)	6	4	1									2	6

Source: Aydın weather station, 1960-2015 data

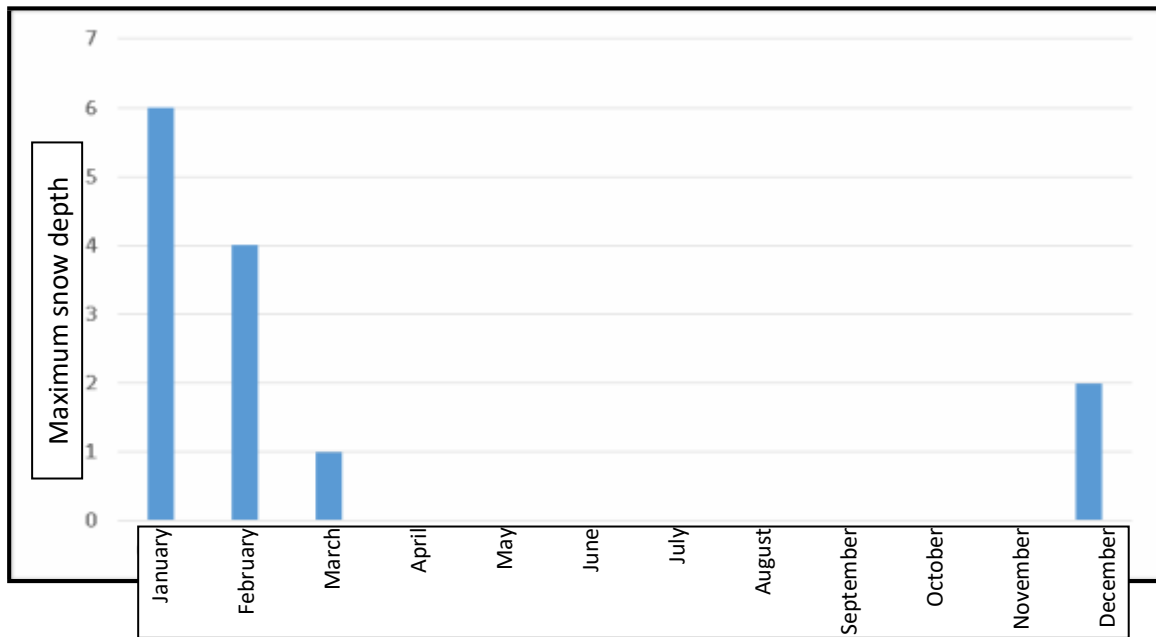


Figure 22. Month-wise distribution of maximum snow depth from the Aydın Weather Station

Evaporation Status

According to 1960-2015 observation records of Aydın Weather Station, annual average open surface evaporation is 119.1 mm, and maximum open surface evaporation 13.7 mm which was measured in August. Other values are given in Table 18, whereas the graphical representation thereof is in Figure 23.

Table 18. Evaporation data from the Aydın Weather Station

METEOROLOGICAL PARAMETER	MONTHS												
	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 weather station, 1960-2015 data

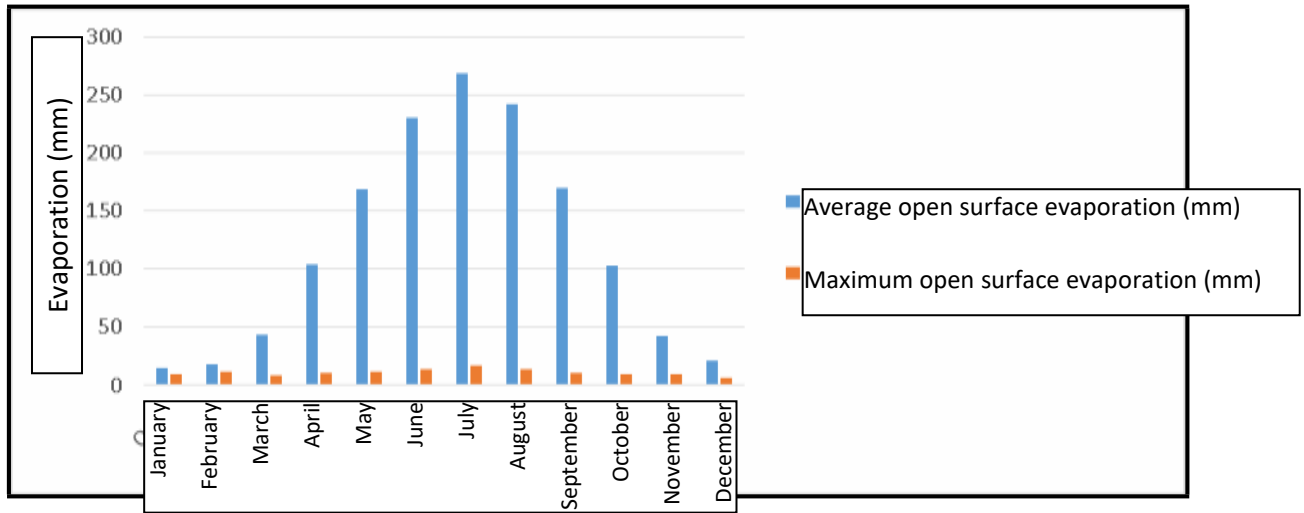


Figure 23. Graphical representation of average and maximum open surface evaporation from the Aydin Weather Station

Wind Distribution

According to 1960-2015 long-period number of blows of Aydin weather station, the primary dominant wind direction is east (E), the secondary dominant wind direction is east-southeast (ESE), and the tertiary dominant wind direction is west (W).

Average Wind Speed

According to 1960-2015 observation records of Aydin weather station, the annual average wind speed is 1.74 m/sec.

The monthly average wind speed data from the Aydin Weather Station is given in Table 19, whereas the graphical representation thereof in Figure 24.

Table 19. Monthly average wind speed data from the Aydin Weather Station

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average wind speed (m/sec.)	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: Aydin weather station, 1960-2015 data

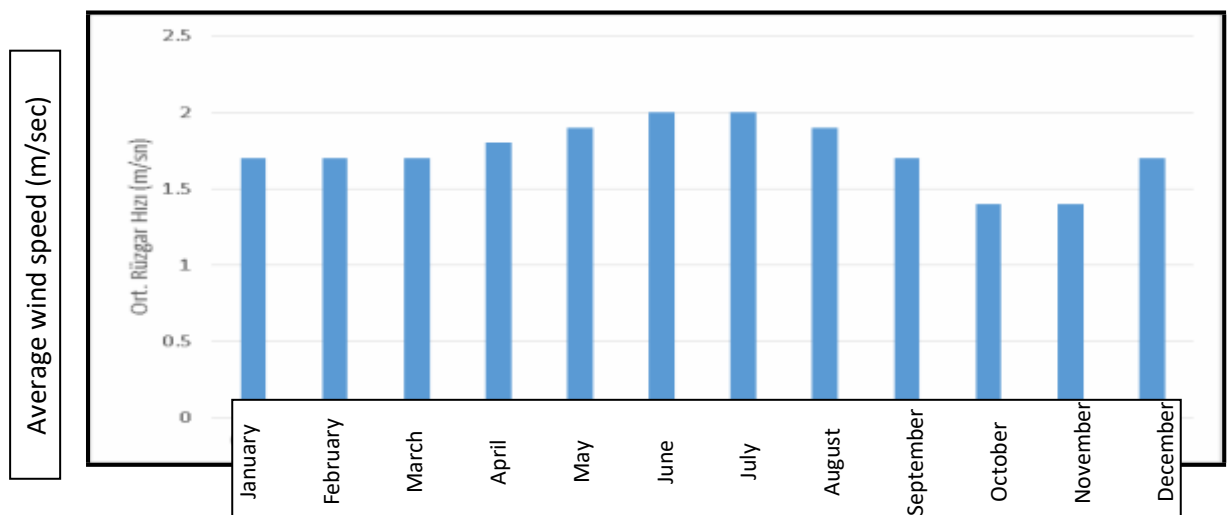


Figure 24. Graphic of monthly average wind speed from the Aydin Weather Station

Direction and speed of fastest wind

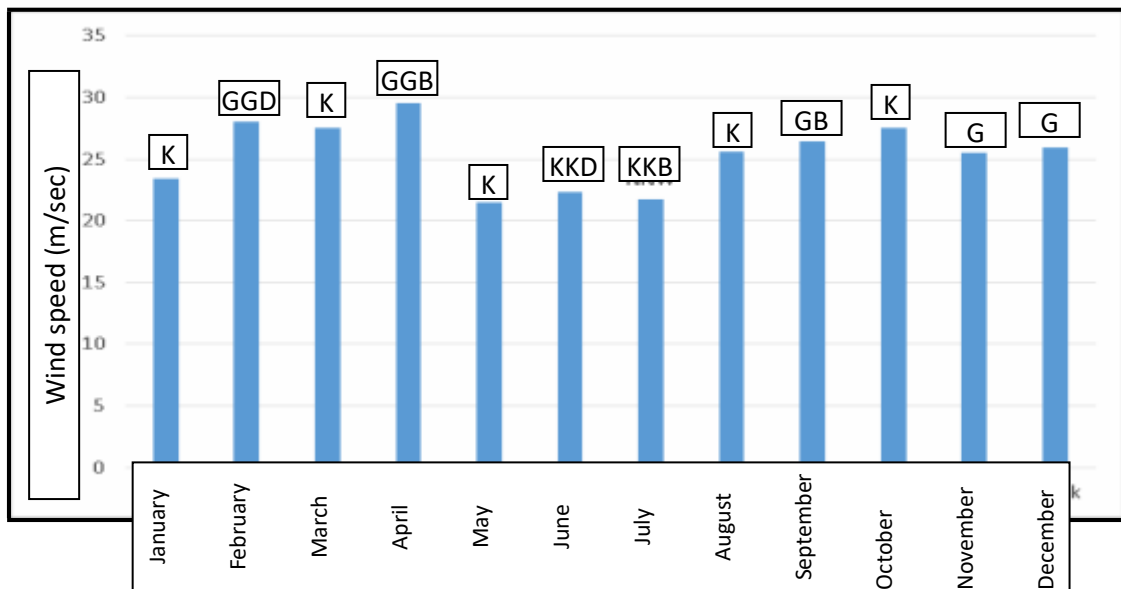
According to 1960-2015 observation records of Aydın weather station, the direction of the maximum wind observed is WSW (west-southwest), whereas its speed is 28 m/sec.

Fastest wind direction and speed data from the Aydın Weather Station is in Table 20, whereas the graphical representation thereof is in Figure 25.

Table 20. Fastest wind direction and speed data from the Aydın Weather Station

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Maximum wind speed (m/sec.)	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 weather station, 1960-2015 data

**Figure 25. Graphic of maximum wind speed from the Aydın Weather Station****Number of stormy and strong windy days**

According to 1960-2015 observation records of Aydın weather station, the annual average number of stormy days is 0.31. The annual average number of strong windy days is 4.73.

Number of stormy and strong windy days are given in Table 21; whereas the graphical representation of the data, is in Figure 26

Table 21. Number of stormy and strong windy days data from the Aydın Weather Station

METEOROLOGICAL PARAMETER	MONTHS												
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average 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
Average number of strong windy days	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 weather station, 1960-2015 data

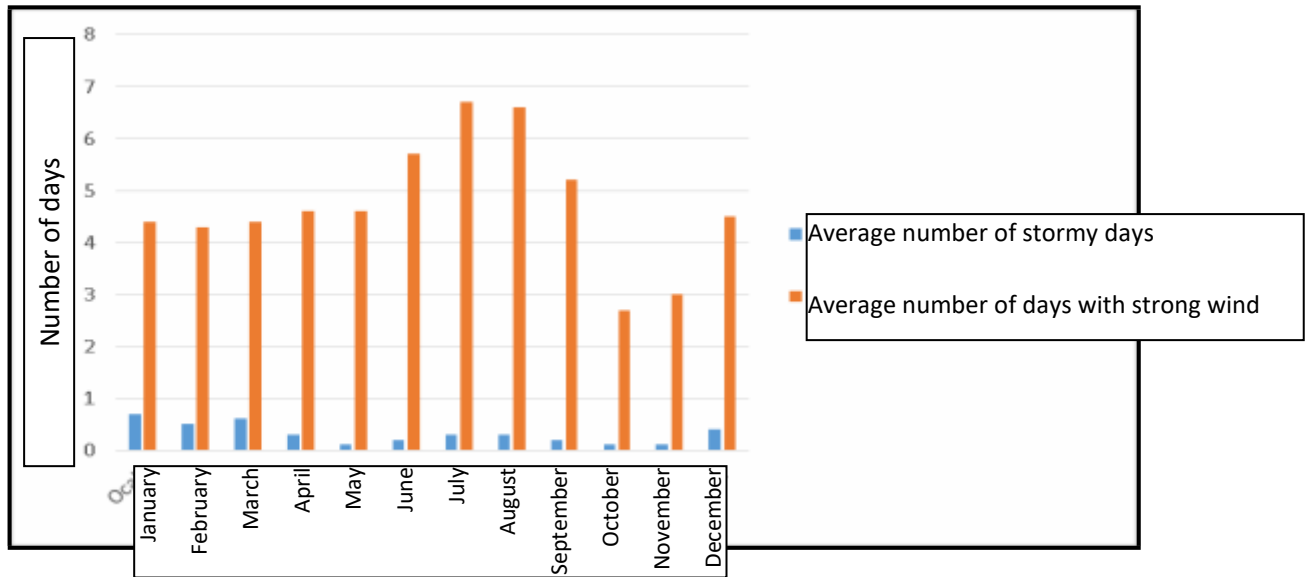


Figure 26. Graphic of number of stormy and strong windy days from the Aydın Weather Station

Annual, seasonal and monthly distribution of wind direction

According to 1960-2015 observation records of Aydın weather station, the average wind speeds and the total number of blows are given Table 22 and Table 23, respectively. Annual wind diagram by the number of wind blows is given in Figure 27.

Table 22. Average speed of wind by direction

DIRECTION	METEOROLOGICAL PARAMETER	MONTHS												ANNUAL
		JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	
N	Average speed of wind	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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 weather station, 1960-2015 data

Table 23. Total number of wind blows by direction

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

Source: Aydın weather station, 1960-2015 data

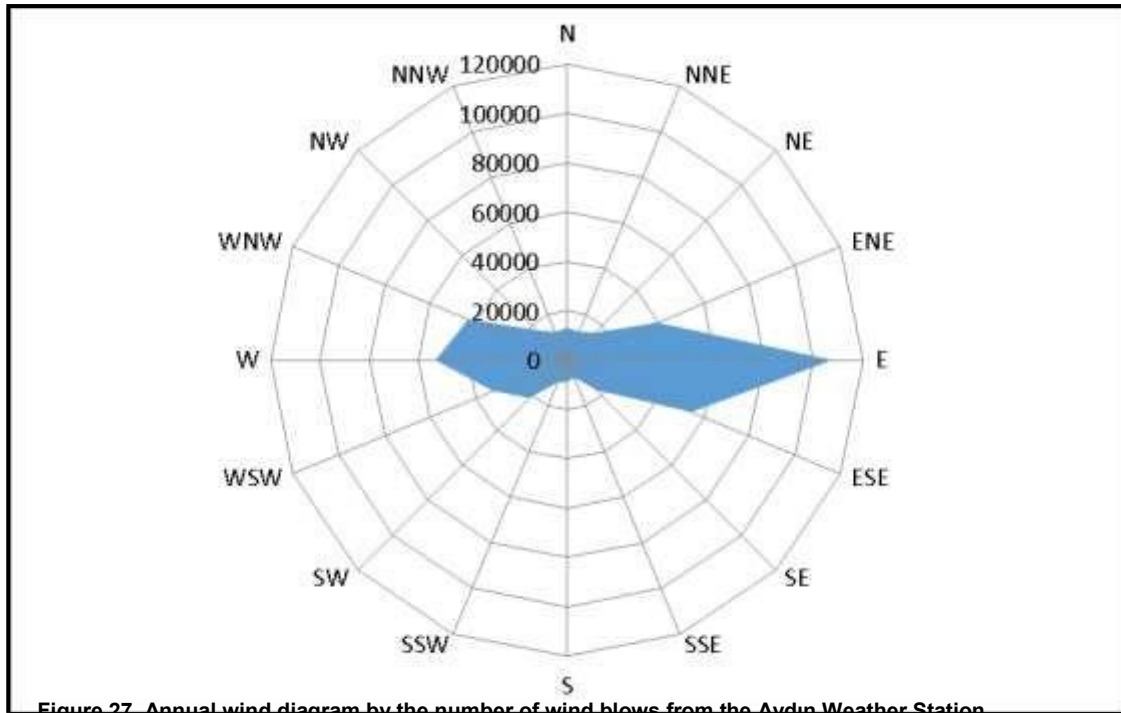


Figure 27. Annual wind diagram by the number of wind blows from the Aydın Weather Station

Annual wind diagram by average wind speed is given in Figure 28.

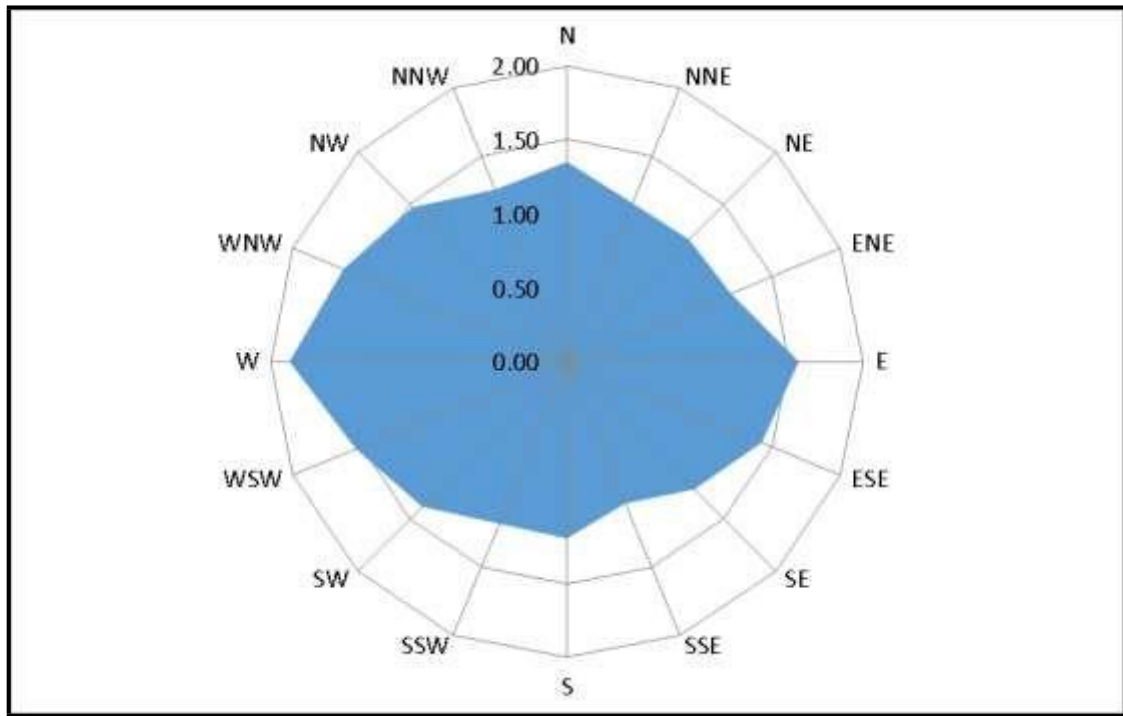


Figure 28. Annual wind diagram by average wind speed from the Aydın Weather Station

According to the observation records of Aydın weather station, the total of seasonal number of blows is given in Table 24, whereas the seasonal wind diagrams by number of blows are given in Figure 29.

Table 24. Total seasonal number of wind blows by direction from the Aydın Weather Station

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

Source: Aydın weather station, 1960-2015 data

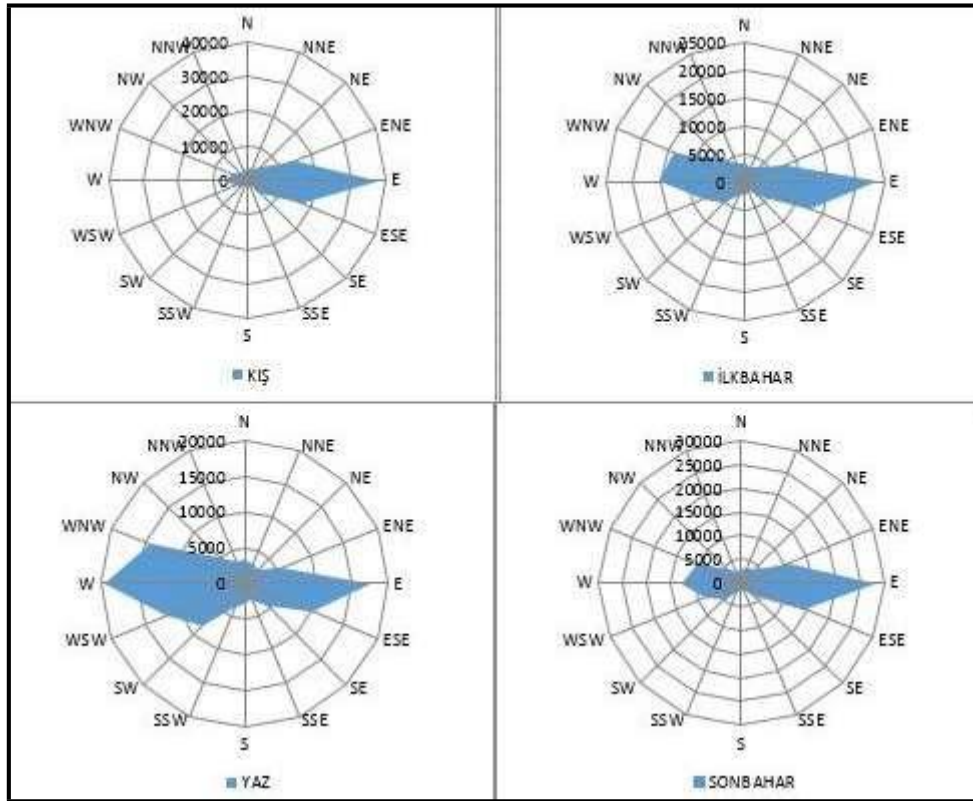


Figure 29. Seasonal wind diagram by the number of blows from the Aydın Weather Station

Monthly wind diagrams by the number of blows from the Aydın Weather Station are given in Figure 30.

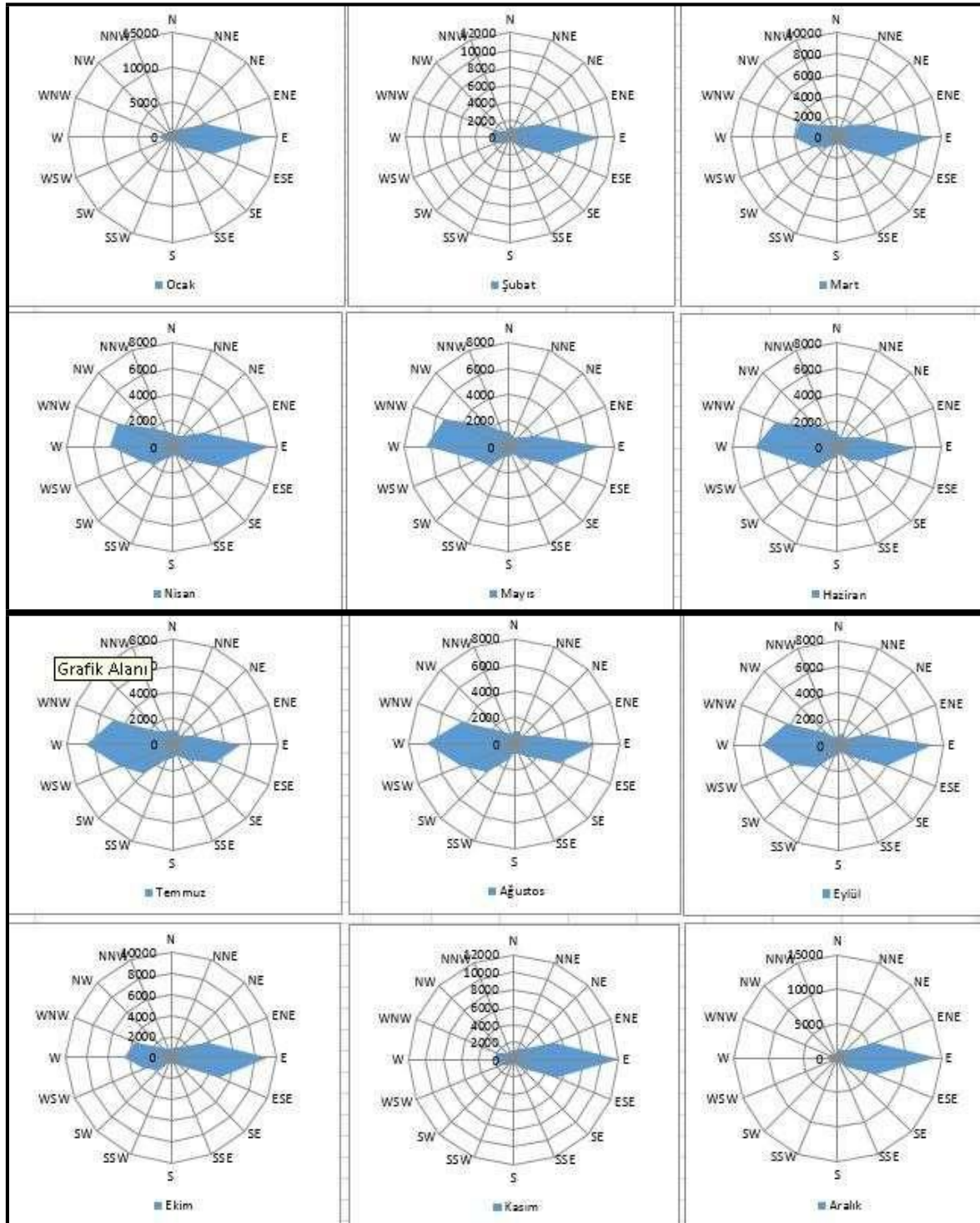


Figure 30. Monthly wind diagram by the number of blows from the Aydın Weather Station

Extraordinary event information

The maximum precipitation values observed at standard times of Aydın weather station and precipitation-intensity-duration-recurrence curves as well as extraordinary event information have been obtained confirmedly from Turkish State Meteorological Service of the Ministry of Forestry and Water Affairs.

Table 25. Extraordinary meteorological event data of the Aydın Weather Station

DATE	PLACE	EVENT	DAMAGE
15.10.1977	Aydın	Precipitation and flood	Agricultural products damaged due to precipitation and floods
30.10.1980	Aydın	Hail	Hail damaged agricultural products
16.12.1981	Aydın	Precipitation and flood	Agricultural products damaged as a result of overflow of streams
11.02.1984	Aydın	Precipitation and flood	Agricultural products, the environment and residential areas damaged as a result of overflow of streams
16.05.1998	Aydın	Precipitation and flood	Agricultural products damaged due to precipitation and floods
24.05.2003	Aydın	Hail	It tilted the crops and grains fell off
06.03.2004	Aydın	Frost	Tilted crops
07.03.2004	Aydın	Frost	Crops damaged due to frost
14.11.2004	Aydın	Storm	Communication and energy transmission lines damaged
30.05.2005	Aydın	Hail	Vegetable gardens were damaged
26.02.2006	Aydın	Hail	Industrial plants were damaged
24.06.2007	Aydın	High temperature	Forest fire outbreak
27.06.2007	Aydın	High temperature	Decreased stream water levels or dried out streams
01.09.2007	Aydın	High temperatures	Decreased stream water levels or dried out streams
22.11.2008	Aydın	Storm	Residential areas were damaged
23.11.2008	Aydın	Storm	Residential areas were damaged
02.01.2009	Aydın	Precipitation and flood	Tilted crops
23.01.2009	Aydın	Storm	Human-animal transportation and residential areas were damaged
26.01.2009	Aydın	Hail	Vegetable gardens were damaged
09.02.2009	Aydın	Hail	Road transportation disrupted
19.02.2009	Aydın	Precipitation and flood	Cultivated agricultural areas were inundated
26.01.2010	Aydın	Frost	Trees damaged by frost
16.10.2010	Aydın	Precipitation and flood	Residential areas were damaged
10.12.2010	Aydın	Precipitation and flood	Human-animal transportation and residential areas were damaged
22.01.2011	Aydın	Precipitation and flood	Cultivated agricultural areas were inundated
17.05.2011	Aydın	Hail	Road transportation disrupted
10.06.2011	Aydın	Hail	Road transportation disrupted
16.06.2011	Aydın	Hail	Tree branches were broken.
07.10.2011	Aydın	Precipitation and flood	Industrial plants were damaged
09.10.2011	Aydın	Whirlwind	People were damaged
07.12.2011	Aydın	Precipitation and flood	Rail transportation disrupted
25.01.2012	Aydın	Precipitation and flood	Cultivated agricultural areas were inundated
30.05.2012	Aydın	Precipitation and flood	Rail transportation disrupted
03.06.2012	Aydın	Hail	Fruits dropped off from trees
03.04.2013	AYDIN	Full storm (24.5-28.4 m/sec.)	Human-animal transportation and residential areas were damaged
17.07.2013	AYDIN	Strong storm (20.8-24.4 m/sec.)	Trees were uprooted
01.10.2013	AYDIN	Storm Whirlwind	Trees were uprooted
02.10.2013	AYDIN	Heavy precipitation, flood, inundation	Human-animal transportation and residential areas were damaged
27.04.2014	AYDIN	Hail	Cultivated agricultural areas were damaged
17.09.2014	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged
13.11.2014	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged
20.11.2014	AYDIN	Heavy precipitation, flood, inundation	Road transportation disrupted
08.12.2014	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged

27.12.2014	AYDIN	Heavy precipitation, flood, inundation	Cultivated agricultural areas were damaged
07.01.2015	AYDIN	Frost	Cultivated agricultural areas were damaged
31.01.2015	AYDIN	Storm Whirlwind	Tree branches were broken.
27.02.2015	AYDIN	Storm Whirlwind	Residential areas were damaged
06.04.2015	AYDIN	Storm Whirlwind	Tree branches were broken.
03.06.2015	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged
03.06.2015	AYDIN	Hail	Human-animal transportation and residential areas were damaged
06.08.2015	AYDIN	Storm Whirlwind	Residential areas were damaged
22.09.2015	AYDIN	Heavy precipitation, flood, inundation	Human-animal transportation and residential areas were damaged
21.10.2015	AYDIN	Heavy precipitation, flood, inundation	Human-animal transportation and residential areas were damaged
15.10.1977	Aydin	Precipitation and flood	Agricultural products damaged due to precipitation and floods
30.10.1980	Aydin	Hail	Hail damaged agricultural products
16.12.1981	Aydin	Precipitation and flood	Agricultural products damaged as a result of overflow of streams
11.02.1984	Aydin	Precipitation and flood	Agricultural products, the environment and residential areas damaged as a result of overflow of streams
16.05.1998	Aydin	Precipitation and flood	Agricultural products damaged due to precipitation and floods
24.05.2003	Aydin	Hail	It tilted the crops and grains fell off
06.03.2004	Aydin	Frost	Tilted crops
07.03.2004	Aydin	Frost	Crops damaged due to frost
14.11.2004	Aydin	Storm	Communication and energy transmission lines damaged
30.05.2005	Aydin	Hail	Vegetable gardens were damaged
26.02.2006	Aydin	Hail	Industrial plants were damaged
24.06.2007	Aydin	High temperature	Forest fire outbreak
27.06.2007	Aydin	High temperature	Decreased stream water levels or dried out streams
01.09.2007	Aydin	High temperatures	Decreased stream water levels or dried out streams
22.11.2008	Aydin	Storm	Residential areas were damaged
23.11.2008	Aydin	Storm	Residential areas were damaged
02.01.2009	Aydin	Precipitation and flood	Tilted crops
23.01.2009	Aydin	Storm	Human-animal transportation and residential areas were damaged
26.01.2009	Aydin	Hail	Vegetable gardens were damaged
09.02.2009	Aydin	Hail	Road transportation disrupted
19.02.2009	Aydin	Precipitation and flood	Cultivated agricultural areas were inundated
26.01.2010	Aydin	Frost	Trees damaged by frost
16.10.2010	Aydin	Precipitation and flood	Residential areas were damaged
10.12.2010	Aydin	Precipitation and flood	Human-animal transportation and residential areas were damaged
22.01.2011	Aydin	Precipitation and flood	Cultivated agricultural areas were inundated
17.05.2011	Aydin	Hail	Road transportation disrupted
10.06.2011	Aydin	Hail	Road transportation disrupted
16.06.2011	Aydin	Hail	Tree branches were broken.
07.10.2011	Aydin	Precipitation and flood	Industrial plants were damaged
09.10.2011	Aydin	Whirlwind	People were damaged
07.12.2011	Aydin	Precipitation and flood	Rail transportation disrupted
25.01.2012	Aydin	Precipitation and flood	Cultivated agricultural areas were inundated
30.05.2012	Aydin	Precipitation and flood	Rail transportation disrupted
03.06.2012	Aydin	Hail	Fruits dropped off from trees
03.04.2013	AYDIN	Full storm (24.5-28.4 m/sec.)	Human-animal transportation and residential areas were damaged
17.07.2013	AYDIN	Strong storm	Trees were uprooted

		(20.8-24.4 m/sec.)	
01.10.2013	AYDIN	Storm Whirlwind	Trees were uprooted
02.10.2013	AYDIN	Heavy precipitation, flood, inundation	Human-animal transportation and residential areas were damaged
27.04.2014	AYDIN	Hail	Cultivated agricultural areas were damaged
17.09.2014	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged
13.11.2014	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged
20.11.2014	AYDIN	Heavy precipitation, flood, inundation	Road transportation disrupted
08.12.2014	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged
27.12.2014	AYDIN	Heavy precipitation, flood, inundation	Cultivated agricultural areas were damaged
07.01.2015	AYDIN	Frost	Cultivated agricultural areas were damaged
31.01.2015	AYDIN	Storm Whirlwind	Tree branches were broken.
27.02.2015	AYDIN	Storm Whirlwind	Residential areas were damaged
06.04.2015	AYDIN	Storm Whirlwind	Tree branches were broken.
03.06.2015	AYDIN	Heavy precipitation, flood, inundation	Residential areas were damaged
03.06.2015	AYDIN	Hail	Human-animal transportation and residential areas were damaged
06.08.2015	AYDIN	Storm Whirlwind	Residential areas were damaged
22.09.2015	AYDIN	Heavy precipitation, flood, inundation	Human-animal transportation and residential areas were damaged
21.10.2015	AYDIN	Heavy precipitation, flood, inundation	Human-animal transportation and residential areas were damaged

The maximum precipitation values observed at standard times and precipitation-intensity-duration-recurrence curves as well as extraordinary event information will be taken into account in all phases of the project.

The table and figure of highest precipitation values observed at standard times with the meteorological bulletin during 1960-2015 in Aydın weather station and the long-period extraordinary event report are given in Annex-8.

II.1.2. Geological characteristics (regional geology, 1/25,000-scale general geological map, stratigraphic column sections, Geology of the Project site, large-scale (1/25,000 or 1/100,000, if any) geological map of the examined area and sections of the units under the Project, Mass movements (landslide/debris-slide), sensitivity analysis, landslide risk map, landslide-precipitation relationship, slope stability, slide analysis; Seismicity and natural disaster potential, geotechnical study report of the project, if any)

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 Environment status report 2011 for Aydın Province

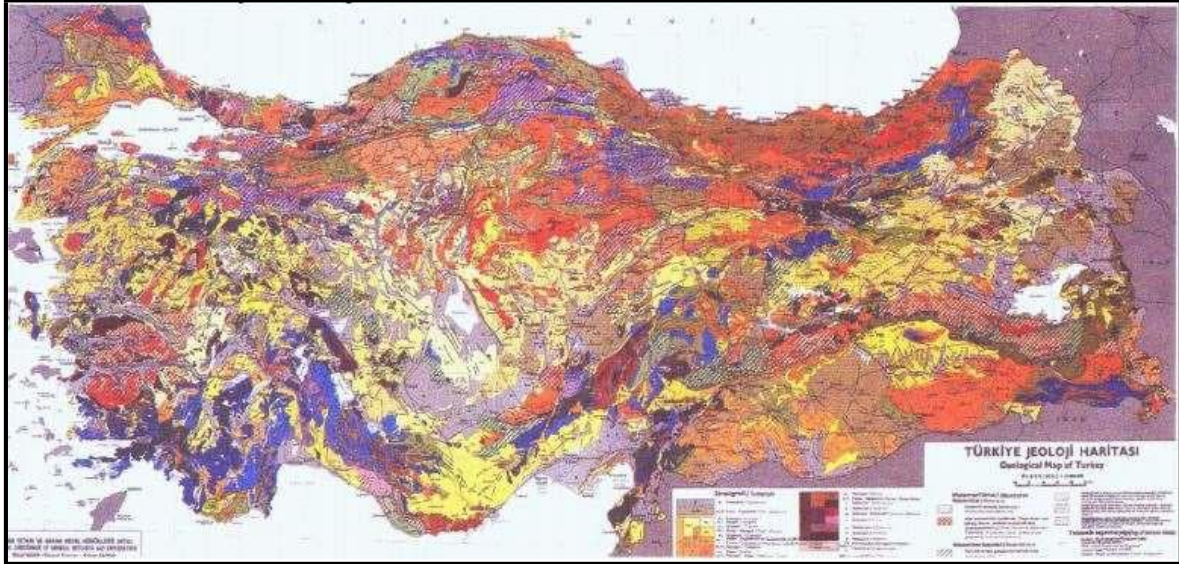


Figure 31. Geological map of Turkey

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-Selçuk-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 disappeared.

Migmatite: It is observed locally in lens shape between augen-gneiss derived from sedimentary rock and gneiss. It has generally banded, folded and pygmatic 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 colors, 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 color is grey and light purplish grey. Massif rest schistosity is observed hardly. The fact that they are significantly affected by joint systems is because they are hard. They contain veins similar to pegmatite. They seem 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, and 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 its surroundings.

Kavaklıdere Group (Palaeozoic aged cover of Menderes Massif): Rocks composed of meta conglomerate, quartzite, quartz schist, mica schists, marble, metabasic and phyllites showing low grade metamorphism characteristics constitute this group. It is Lower Paleozoic-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 vertically pass into quartzite, quartz schist, garnet schist, mica schist, chlorite, muscovite schist, phyllite and calcschists. The sequence also includes marble and metabasic, metachert bands and lenses. Chloritoid schists contain dark grey and black marble bands and lenses.

In the Kavaklıdere group, various schist is observed towards the top in addition to quartz schist and quartzite. The uppermost sections of the sequence, which contains granat schists, mica schists, chloritoid-disten schists respectively, are phyllites. The rock is blackish colored with a distinctive and thin foliation. The most dominant lithology among schists is garnet - micaschists, which are observed in light brown and dirty yellow colors. 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 towards upward 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 south 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-colored, 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): Büyük 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) expose around Didim. The Neogene sediments of the Büyük 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 Büyük 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 Büyük 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 (around Buldan). They are originated 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 color. 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 colored feldspar minerals and dark colored 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 Paleozoic 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 32.

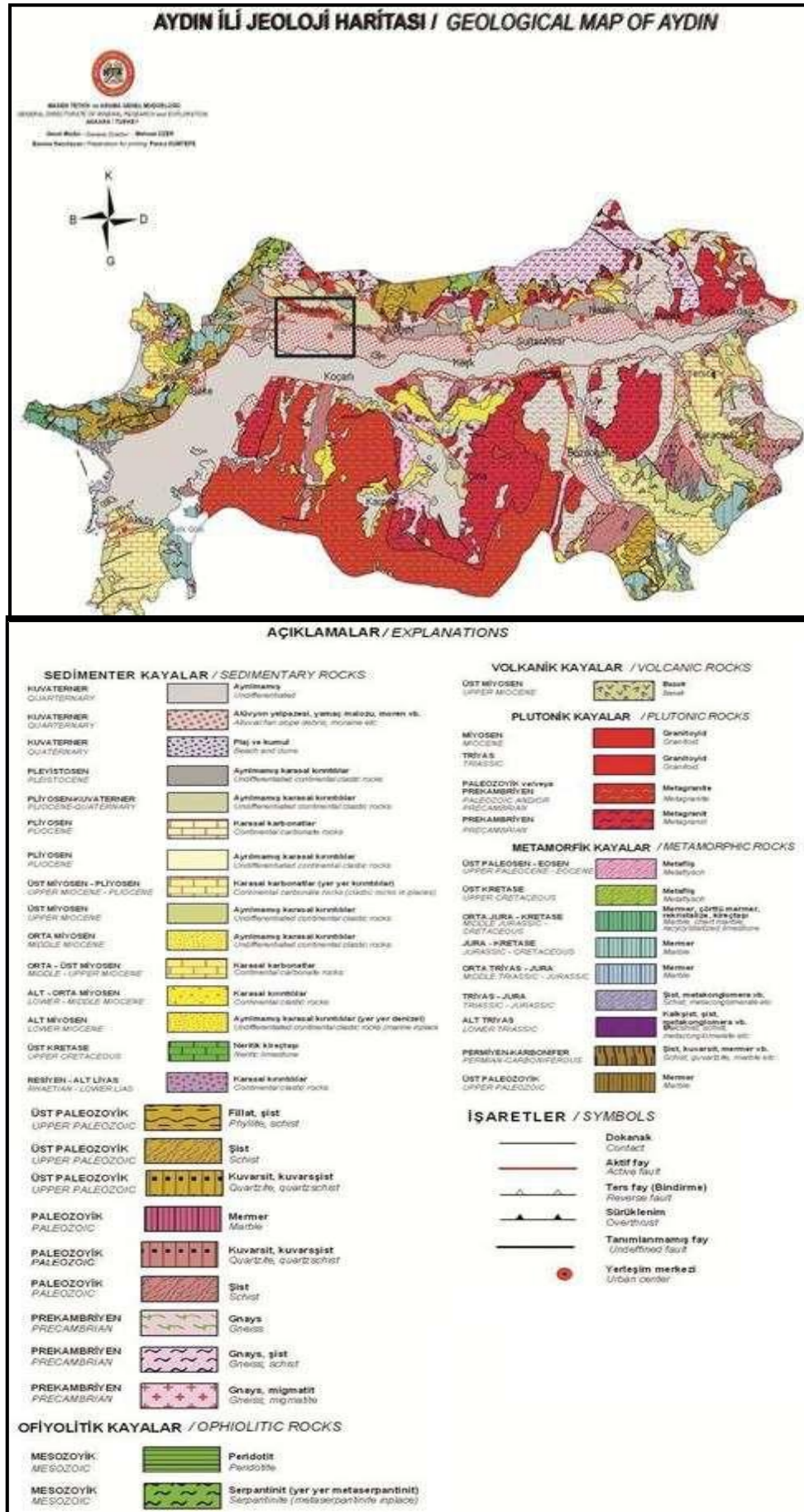


Figure 32. Geological map of Aydın Province

Metamorphism and magmatism⁴

The sequence in general are represented with Paleozoic aged crystalline series are Neogene aged formations and Quaternary aged alluviums. Paleozoic 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 at the mouths of side streams with large alluvial fields.

Metamorphic rocks

Paleozoic: In the region, Paleozoic is represented by metamorphic crystalline schists called Menderes Massif. This series called Menderes Massif is as follows:

Permo-Carboniferous - crystalline limestones intercalated with 200 m schist and quartzite, Devonian - 1000 m marbles,
Silurian - 1000 m various schists and quartzites,
Silurian - Greenschists,
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 Paleozoic, and Neogene.

Neogene is composed of sand and gravel, conglomerate sandstone, clay, marl and limestone intercalations with various sizes. 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 colored 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.

⁴ Environment status report 2011 for Aydın Province

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 Paleozoic 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 Paleozoic, and Neogene. Neogene is composed of sand and gravel, conglomerate sandstone, clay, marl and limestone intercalations with various sizes. 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 Büyük Menderes massif show that the Alpine movements are still in progress.

Tectonics 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 included in projects carried out by our institution, no such project was conducted for Aydın Province.

The oldest unit outcropping within the project site and its surroundings is the Paleozoic aged gneisses of the Menderes Massif. Paleozoic 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. Babadağ horst, Büyük 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]).

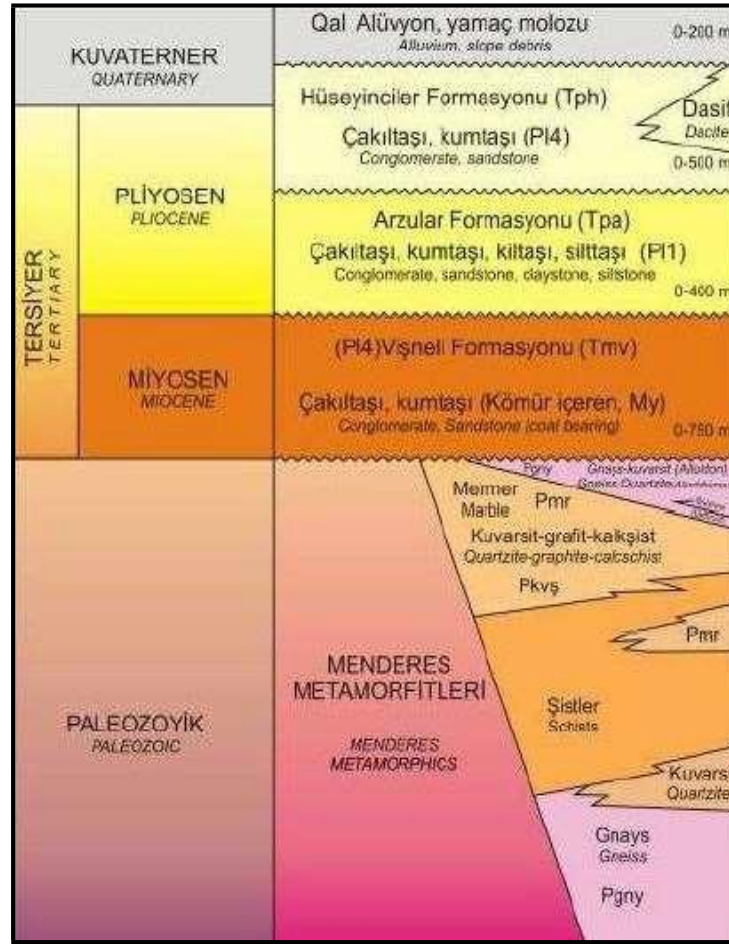


Figure 33. Generalized stratigraphic column section of the project site and its surroundings
Source: Şimşek Ş, 2008

Geology of the Project site⁵

The studies on the geology, hydrogeology, hydro geochemistry, isotope geochemistry and geothermal potential of Germencik and surroundings, which is the study area, have been initiated by the MTA (General Directorate of Mineral Research and Exploration, Ankara) (Çiçekli et al., 1986; Ekingen, 1978; Eres and Alpar, 1984; Gevrek, 1987; Gülay, 1982; Güner ve Yıldırım, 2005; Karamandereşi et al., 1982; Keskin, 1972; Okandan, 1986; Şahin, 2002; Şener, 1984; Şimşek, 1981, 1984, 2003).

The area in question is composed of Menderes Massif metamorphic rocks of Paleozoic age and Miocene, Pliocene and Quaternary aged sedimentary rocks and Middle Miocene aged volcanic rocks. In here, the metamorphic rocks are stratigraphically 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 grained 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. Karamandereşi, 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 would be positive when making initial evaluations for geothermal energy. It also helped to explain the high temperature gradient in the region (Şimşek, 1981).

Büyük Menderes Continental Rift Zone regarding the geothermal source and the project area are given in Figure 34.

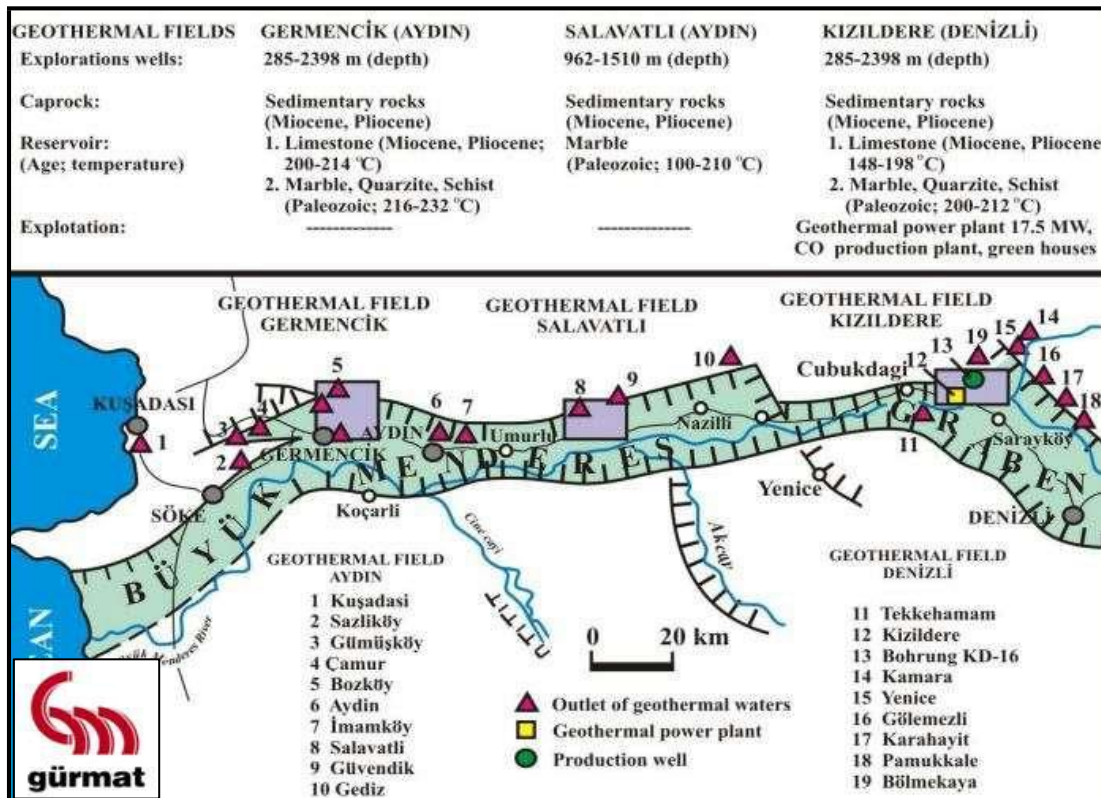


Figure 34. Büyük Menderes continental rift zone and geothermal water locations

Examination on the field of License J-553⁶

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 Pliocene and alluvium units but not reaching the surface.

⁶ Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

The geology map of the project site and its surroundings is given in Figure 35.

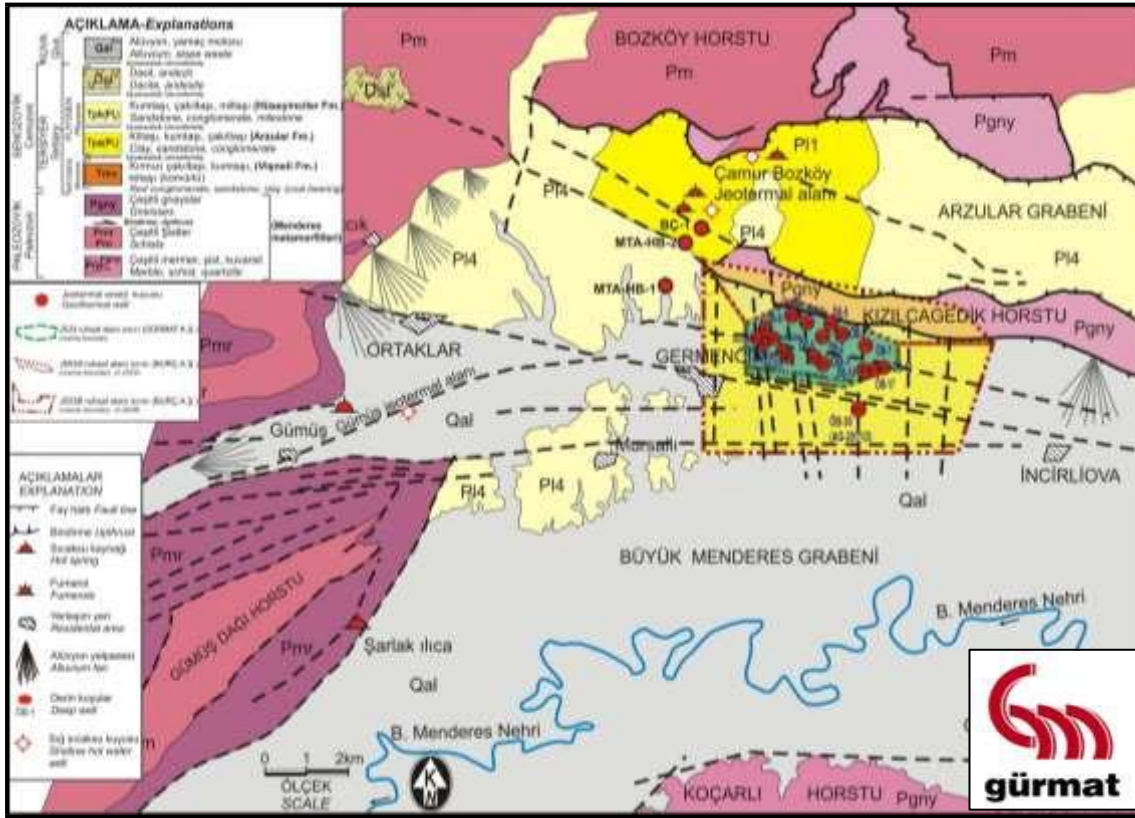


Figure 35. Geological map of the project site and its vicinity

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

Cap 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 indicates that they are meteoric waters with deep and long-term underground circulation. Furthermore, it was calculated by means of 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), which provides high local geothermal gradient in the field, is at a depth of about 9 km and 900 °C.

The conceptual geothermal model of the licensed field J-553 and its surrounding is shown in Figure 36, and the geothermal section is shown in Figure 37.

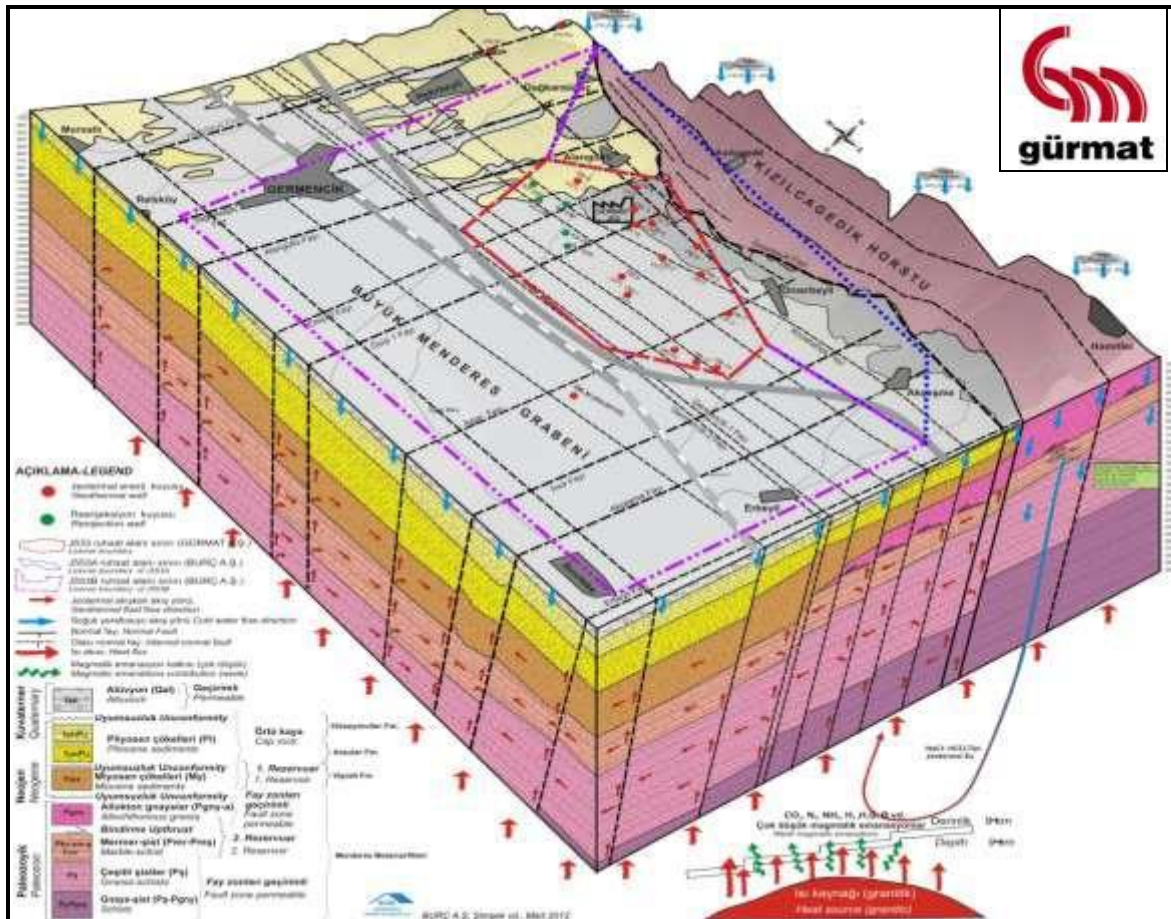


Figure 36. Conceptual geothermal model of the licensed field no. J-553

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

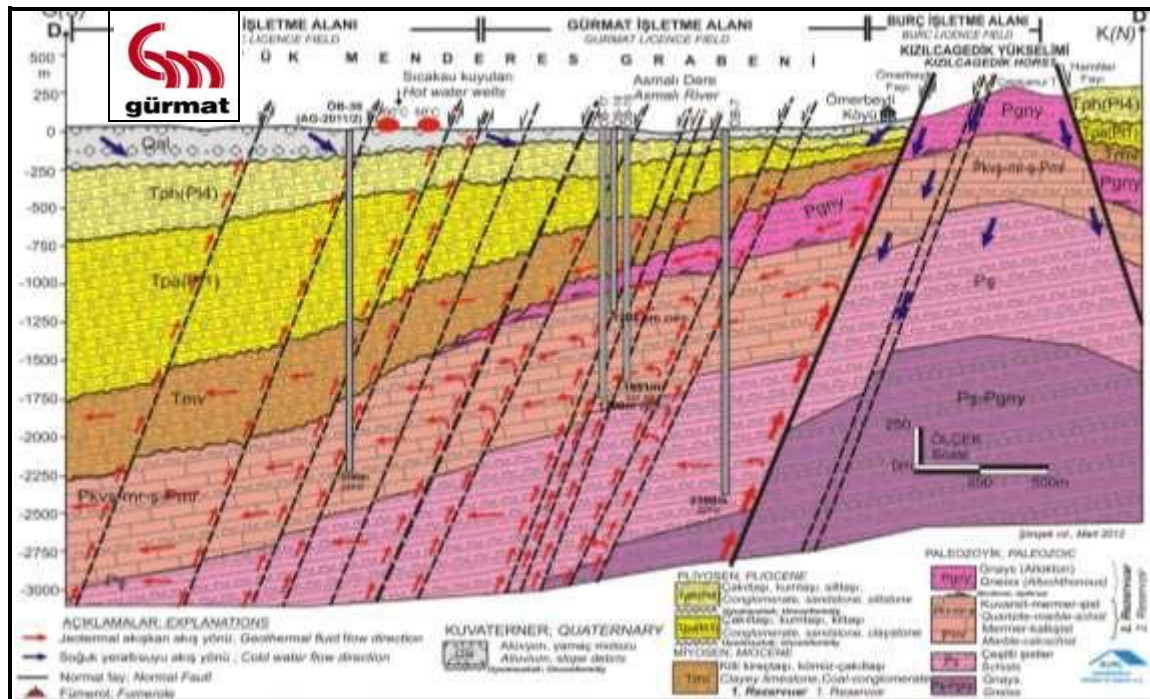


Figure 37. Cross section of the conceptual geothermal model of the licensed field no. J-553

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

The Geological-Geotechnical Survey Report prepared within the scope of the project is presented in Annex-17.

Natural disaster and seismicity circumstances of the project site and its sphere of influence

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

The general tectonic map of Turkey is given in Figure 38.

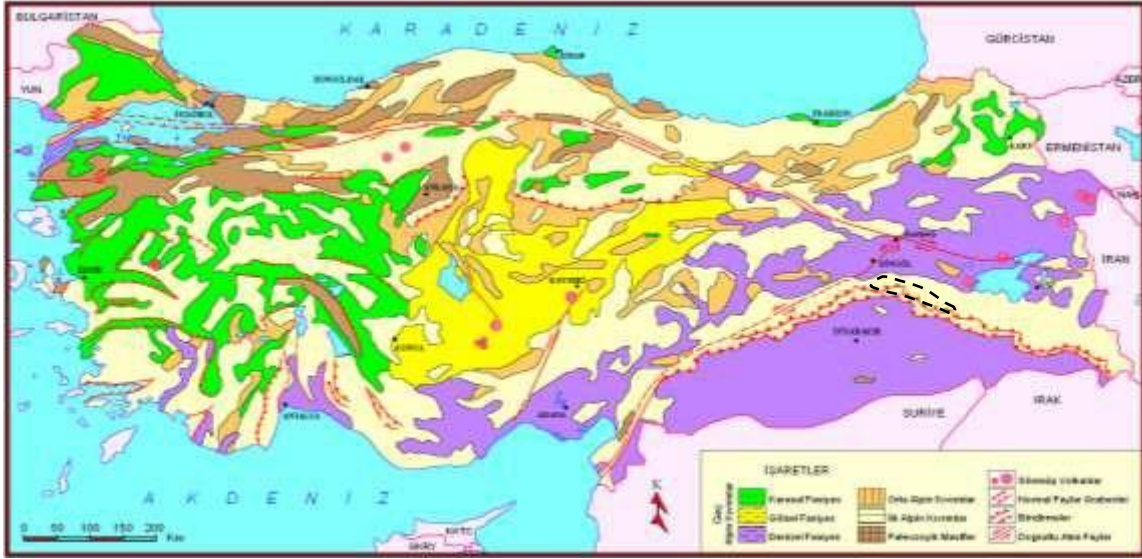


Figure 38. General tectonic map of Turkey



Figure 39. Distribution of active faults in the main land of Turkey to 1:25.000-scale sheets

Source: Updated active fault maps of Turkey and their importance in determination seismic hazard hazards, General Directorate of MTA, Department of Geological Surveys

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

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

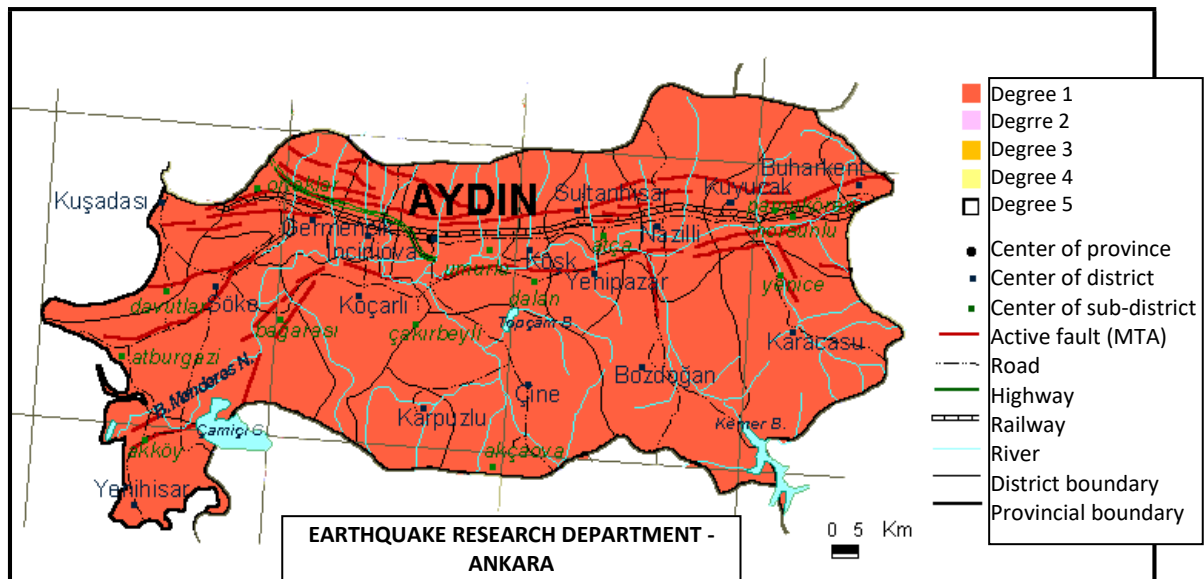


Figure 40. Aydın seismic zone classification

In 1653, a major earthquake occurred in Aydın and some part of the city on the plain subsided and rails were folded because of the fractures crossing the railroad.

The earthquake of 1653 caused great damage in districts Nazilli, Kuyucak, Sultanhisar, and Köşk in addition to Aydın city center; ground splits and water gushes occurred.

An eccentric earthquake occurred in 1899 in Nazilli and caused a great loss of life and property and some fractions up to 50 km in total length occurred parallel with the axis of the Büyük Menderes depression.

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

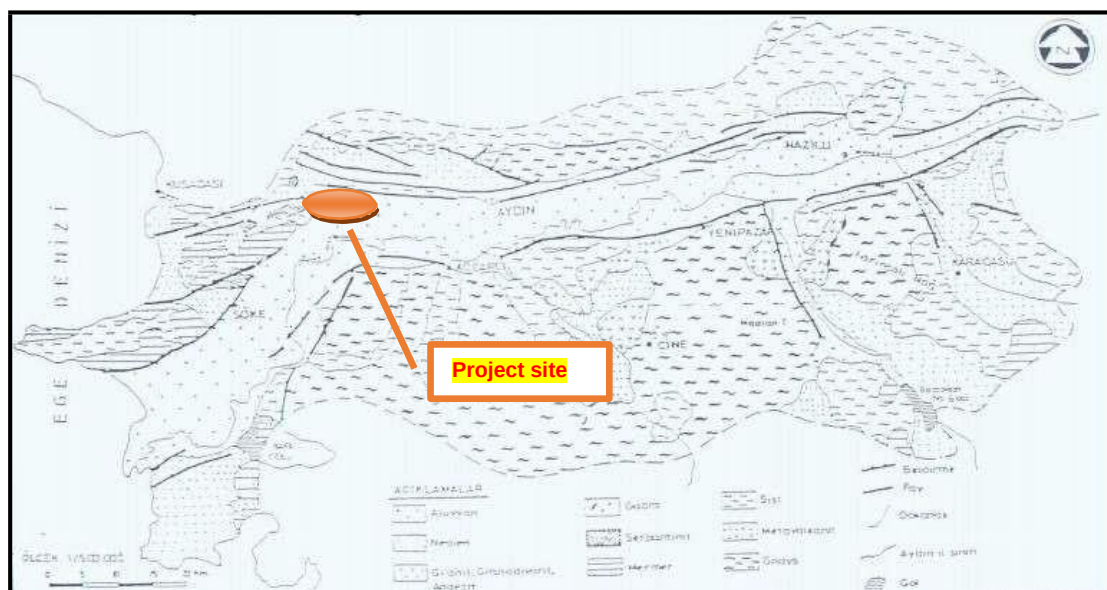


Figure 41. Fault map of Aydın Province

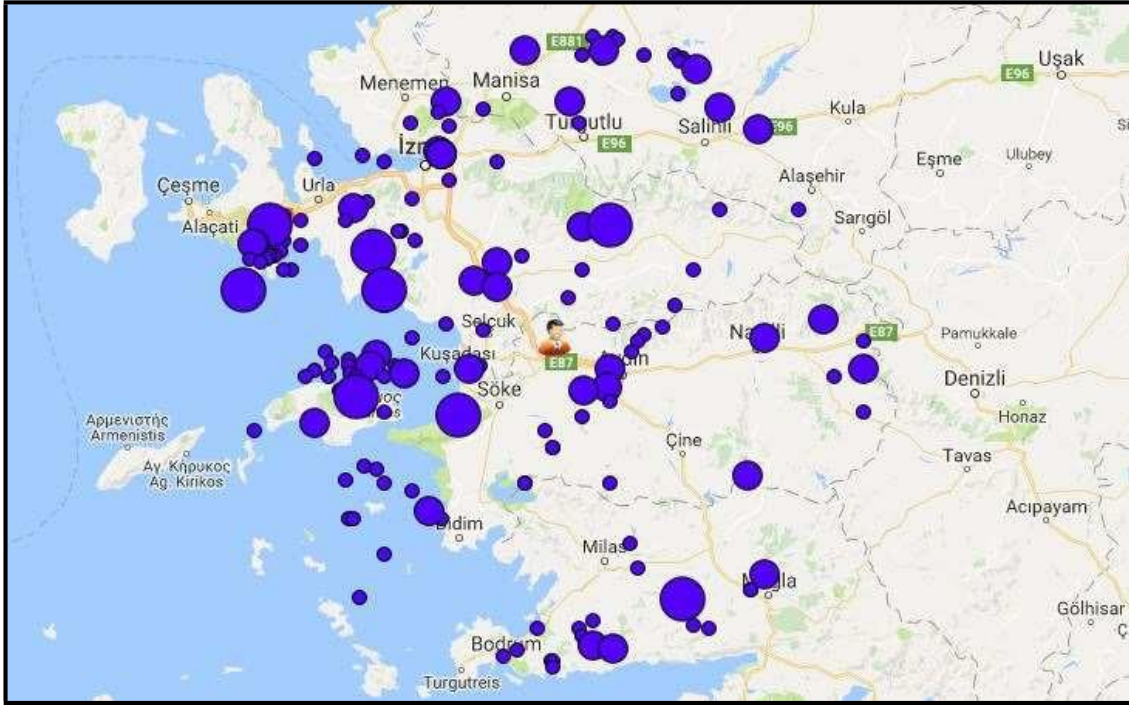


Figure 42. Major earthquakes in the 100-km area where the project site is located

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

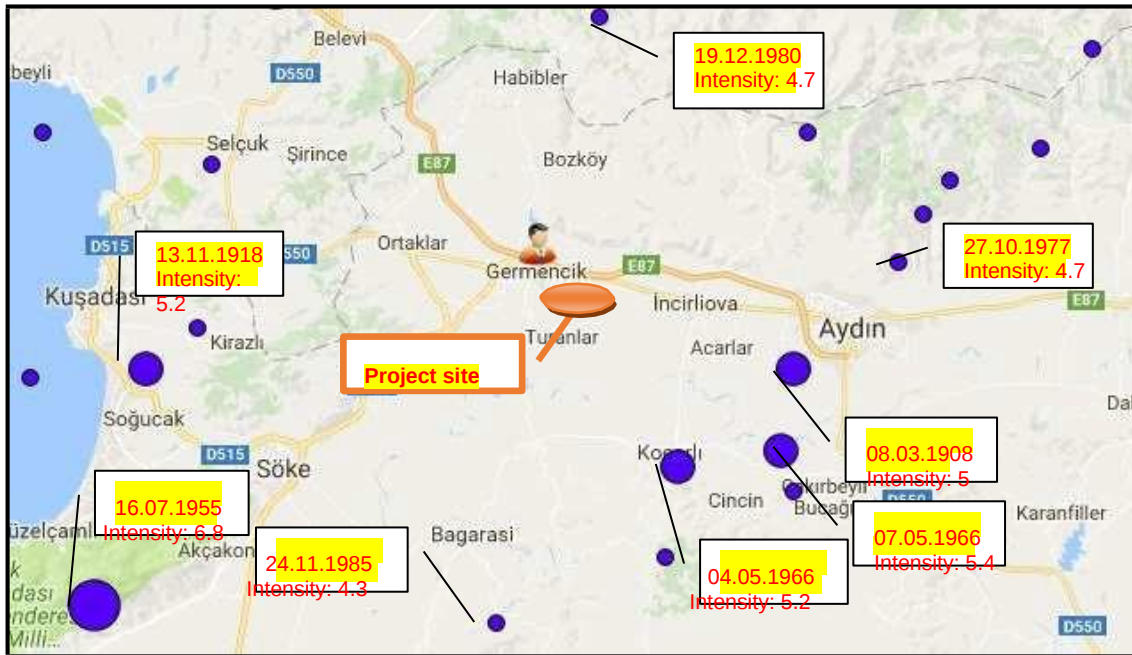


Figure 43. Dates and intensities of major earthquakes within the region where the project site is located

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 by the abrogated Ministry of Public Works and Settlement in accordance with the provisions of the "Regulation on Buildings to be Constructed on Earthquake Zones" promulgated in Official Gazette issue no 26454 dated 06.03.2007 and the Regulation amending this regulation promulgated in Official Gazette issue no 26511 dated 03.05.2007.

Landslides and avalanches⁷

The Ministry of Public Works and Settlement has transferred, in 2007, 599 houses in Central district-Balıkköy, İmamköy (Gölcük quarter), Musluca, Buharkent-Ericek, Kuyucak-Gencellidere, Kuşadası-Yaylaköy, Germencik-Çamköy- Hıdırbeyli-Kızılcapınar, Söke-Güllübahçe, Sultanhisar-Kabaca due to an landslide disaster and 18 houses in Söke-Güneyyaka village due to a rock-fall disaster.

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 Aydın province. Büyük Menderes River, which has its source within the boundaries of Afyon Province, reaches the Aegean Sea within the boundaries of Aydın province, where the branches Akçay and Çine are located as well. In addition to these two branches, there are many streams with flow rates varying in summer and winter. Depending on the size of the precipitation basin of these streams and the intensity of the precipitation, their flow rates increase from time to time, causing a flood effect because of overflows. Such floods cause damage sometimes in residential areas and sometimes in agricultural lands. 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 damage. Rehabilitation works for small streams are carried out to the extent of the possibilities of the relevant administration. Furthermore, information on floods obtained from 21st Regional Directorate of DSİ is as follows: 49.4% of the recorded floods between 1945-1994 occurred in November-December-January period, 30.3% occurred in June-July-August period; nearly all of those floods in the first period occurred along Büyük Menderes river and its branches; the impact areas of these floods were between Sarayköy of Denizli and Söke; the floods of the second period were occurred generally in local dry creeks mainly around Denizli-Acıpayam; moreover, the flood events are significantly under control with the help of flood prevention measures taken by the relevant institution as well as storage facilities founded on the streams; however, the problem still persists in some areas such as Muğla's central district, Söke district and Denizli's Serinhisar; and one of the most significant reasons to this problem is insufficient infrastructure, improper settlement and deterioration of climate and ecological balance in recent years.

As a result of heavy rains in Aydın province on December 10, 2010, there were floods and deluges in Koçarlı district centre and Yeniköy Town of the district, villages Büyükdere, Cincin, Çakmar, Gündüzlü, Kasaplar, Sobuca, Yağhanlı, Haydarlı, and Boydere, Bağarası town of Söke District, the villages of Avcılar and Çalışlı. According to final damage assessment by the Governorate's Damage Assessment Commission for Gündüzlü village for which a decision on Impact to General Life were made by the Prime Ministry's Disaster and Emergency Management unit, 412 households were affected by this disaster, whereas 3 houses were demolished and 2 house had severe damage, 6 had moderate, and 16 had small damage. The process of ownership of rights is still ongoing.

⁷ Environment status report 2011 for Aydın Province

⁸ Environment status report 2011 for Aydın Province

Forest and grassland fires⁹

Before mentioning the forest fires, below is a brief information about the forest vegetation of Aydın province. The vegetation in these areas are as follows: Black pine, pinus brutia, stone pine, maritime pine, oak varieties, lime tree, chestnut, sycamore, maple, common ash, and poplar, and laurel, sandalwood, terebinth, gumwood, locust, wild pear, blackberry, oleander, etc, which are collectively called macquis. Generally, factors such as relative humidity, temperature, tree species and altitude are effective in terms of 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. Soil structure deteriorates and erosion occurs due to forest fires resulting from different causes. Because of the deterioration of soil structure, the permeability of soil decreases, soil drifts with water and erosion occurs. Thus, soil structure will be maintained, and groundwater will be fed if forest fires are prevented. Forestation of empty and uncultivated areas, high-slope places in particular, would prevent soil from being drifted and soil quality would be maintained. Mediterranean climate and vegetation cover, which is also seen in Aydın province, pave the way for forest fires when relative humidity is low and wind speed is high. Days with temperature higher than normal pose a fire risk in Aydın province, which is in a first-degree sensitive region. Operations conducted by Aydın Forestry Department for preventing forest fires are divided into two main groups, which are preparations before the fire season and operations during the fire season.

According to information from the Forestry Department, uninterrupted surveillance and communication take place by means of 19 watchtowers for controlling and responding any forest fire within the provincial boundaries, and people are 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, efforts are made green belts and new parks, whereas motorized firefighting teams are on duty on a continuous basis throughout the fire season. Furthermore, farmers can cause fire from time to time while cleaning the insides and edges of their fields. Such fires outbreak first within agricultural areas and then may turn into forest fires. As a conclusion the main causes of forest fires in Aydın province are fires in agricultural lands due carelessness and negligence. A fire disaster occurred on 19.04.1981 in Karacaören village of Karacasu district in Aydın province. New houses were built for 31 disaster victims whose houses became useless as a result of this disaster.

⁹ Environment status report 2011 for Aydın Province

II.1.3. Hydrogeological characteristics (groundwater levels; safe draw off values of all kinds of currently available wells such as caissons, deep wells, artesian wells, etc; physical, chemical and bacteriological characteristics of water; current and planned use of groundwater, flow rates, distances to the project site)

The metamorphic rocks of the Menderes Massif are located in the Germencik District of Aydın province. The marbles inside the massif form the main chamber rock. The marbles have a melting cavities in patches and have a fractured structure as a result of the tectonic effects. Due to these properties, they exhibit high porosity and permeability. Micaschists beneath and above the marble have low porosity and permeability. The schists act as cap rocks due to these properties. Gneisses may show high porosity and permeability due to both faulting and their close relationship with marbles in the study area (Karamanderesi, 1989). The loose, sandy, gravelly parts of the Neogene sediments on the basement units have high porosity and permeability and have a reservoir characteristic. The hardened parts of these units and the clayey levels act as cap rocks.

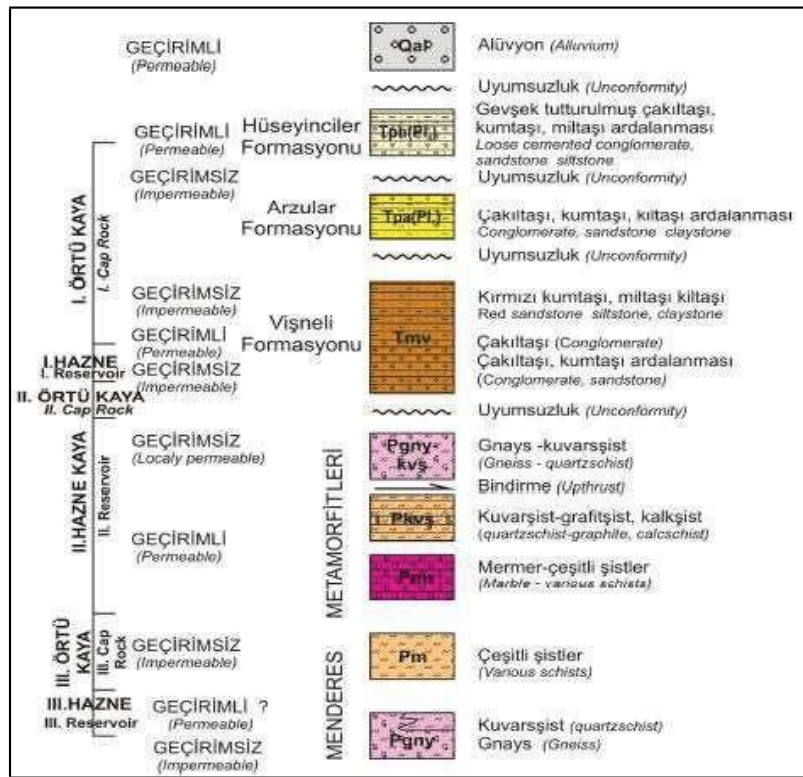


Figure 44. Hydrogeological units of the Germencik area

Groundwater levels¹⁰

In the Aydın-Söke Sub-basin and Nazilli-Kuyucak sub-basins, which are within the boundaries of Aydın province, the groundwater level at the upstream part is 65 m while it reaches 5 m after Söke. Although there is a drop in groundwater levels about 3 meters in the last 20-year period, this can be attributed to the effect of the drainage system of the irrigation project.

¹⁰ Environment status report 2015 for Aydın Province

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 at the plain, the general groundwater and surface water flow direction is from south to north and water 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. At 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 drops in these sections. In the region, Paleozoic aged marbles, sandy-gravelly levels of Tertiary aged units and sandy gravelly levels of Quaternary aged alluvium have an aquifer characteristic.

Hydrogeology of the project site

When the geology of the intended project is examined, it is seen that sedimentary units are widely spread. These units have varying levels of permeability depending on consolidation 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 consolidation level are generally classified as low permeable or impermeable. With the increase in grain size of sedimentary units, the permeability gets increased despite the decrease in porosity.

Alluvium presence, conglomerate, sandstone-mudstone-limestone intercalated units encountered within the project site generally have a permeability value greater than 10-5 cm/s and are semi-permeable, permeable and very permeable. Augene Gneiss-Metagranitoid geological unit can be given as an example of unit classified impermeable.

The area where the intended project site is located completely consists of alluvial and alluvial fan, and its porosity and permeability is high. Based on this information, it can be concluded that the project site is in a permeable - very permeable hydrogeological assessment. Hydrographical map of the project site is given in Figure 45, whereas the hydrogeological map is in Figure 46.

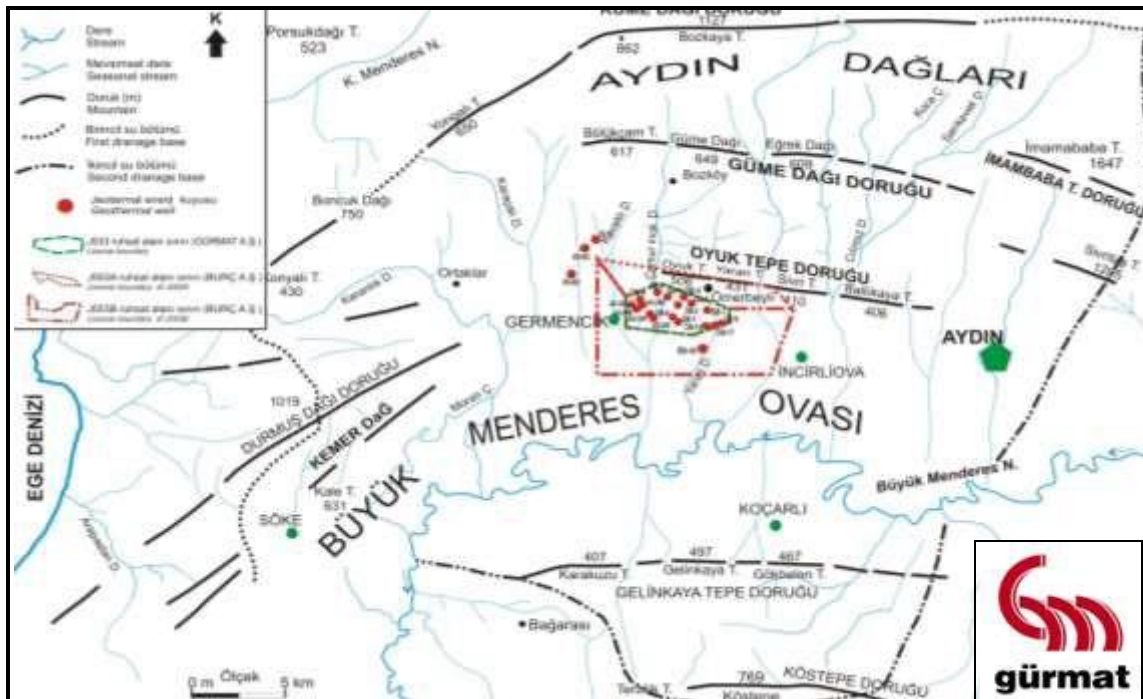


Figure 45. Hydrographic map of the licensed field no J-553

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

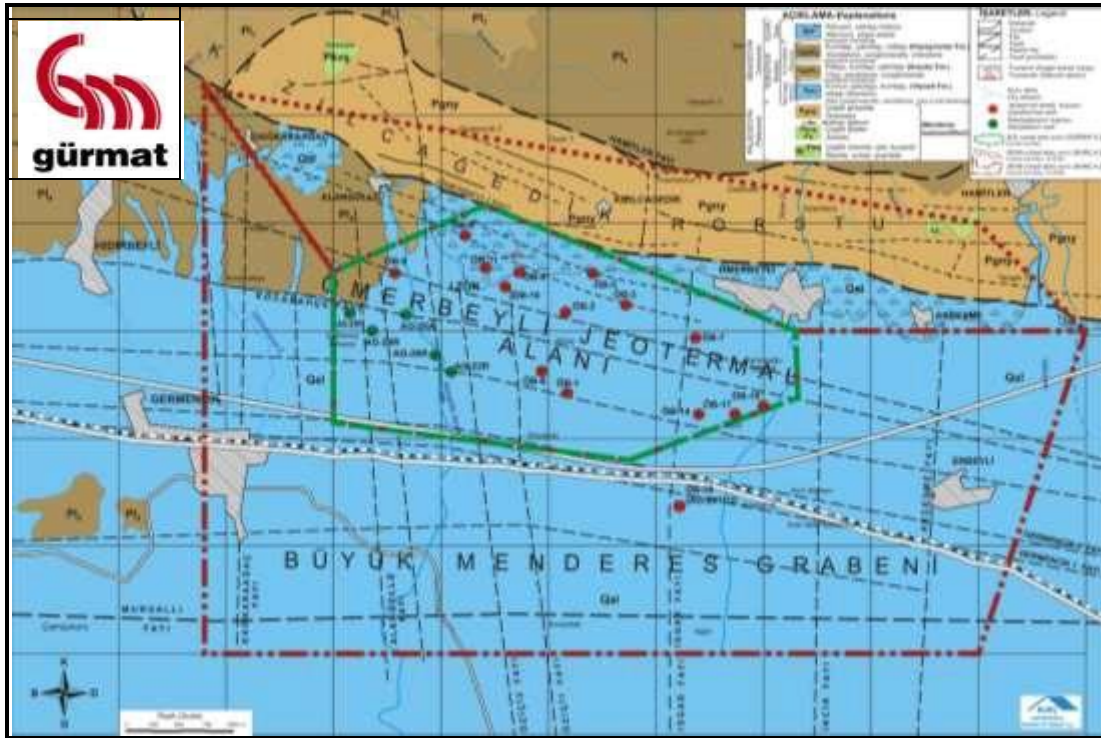


Figure 46. Hydrogeological map of the licensed field no J-553

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

Mineral Water Resources

Thermal and hydrothermal mineral water sources with abundant CO₂ output were observed in fault zones where allochthon gneisses outcrop and iron hydrothermal alterations developed in Arzular Graben. However, their flow rates are low.

Shallow hot water wells

It is noteworthy that hot water was observed in shallow wells with depths 10-150 m drilled in the region for the initial surveys (Şimşek et al., 1980). Hot water was encountered at 50 °C in Ömerbeyli village as well as at 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 exists also free groundwater in stream beds reaching to this plain and in alluvial fans reaching to plains. Cold water is exploited on several levels in the alluvial plain of Büyük Menderes which has a large alluvial area. Groundwater quality is deteriorated due to the geothermal fluid interfering with groundwater along the Ömerbeyli fault, consequently groundwater cannot be used as potable water along the area from the south of Ömerbeyli and Hıdırbeyli to the main road. This situation is stated in DSİ reports before the drilling (DSİ, 1975).

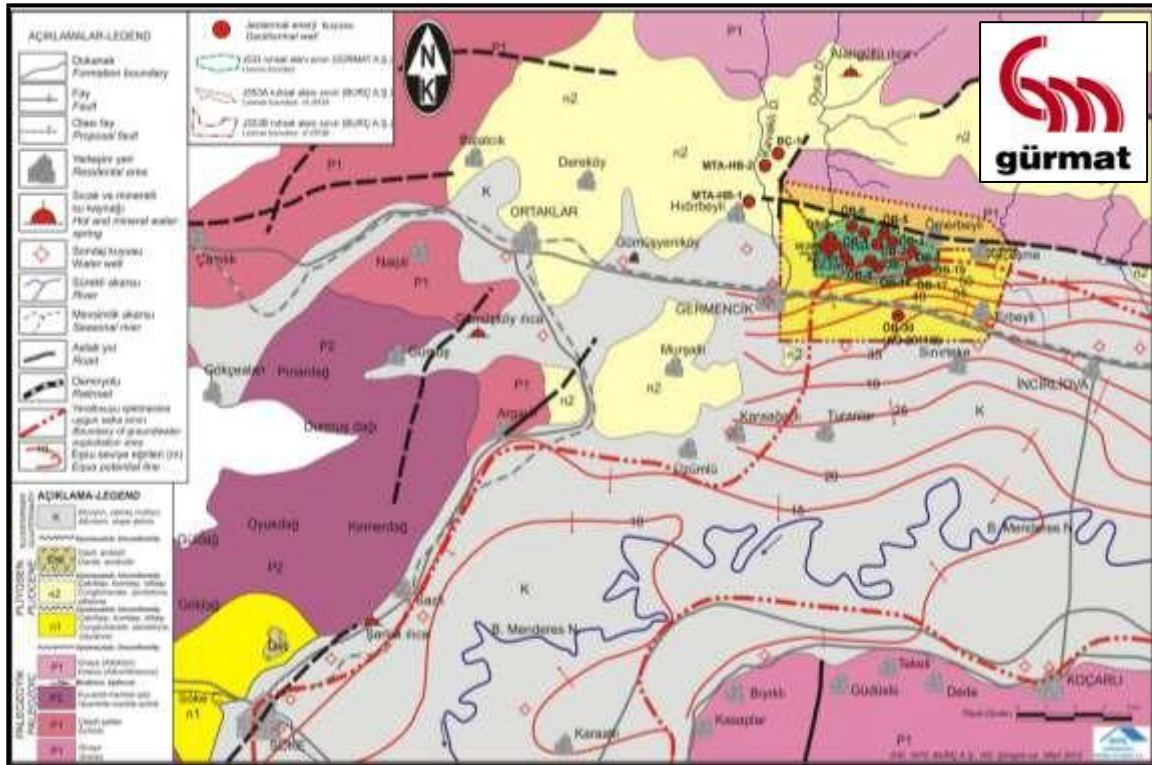


Figure 47. Groundwater within the licensed field no J-553

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

Sources

The map shows cold and hot water sources with low flow rate ($Q=0.1-3$ L/sec.)

Cold water sources

Usually there are cold water sources at low flow near horsts in the forested area and near the main faults at horst edges. Cold spring waters from quartzite, marble and gneisses are transported to settlements in the plains for drinking water use.

Hot water sources

There are many hot springs in the Germencik region, ranging in temperature from 36 to 92 °C. These sources in the north of Kızılçagedik horst are mainly the Çamurılıca and Bozköy sources.

Çamurılıca sources

There are many hot springs reaching 92 °C at 6 km north of Germencik district along the Çamurılıca Stream. These hot springs with a total flow rate nearly 1.5 L/sec. are characterized by $Na > Ca > K$ quality by cations and $Cl > HCO_3 > SO_4$ quality by anions.

Bozkoy thermal spring

It is at 3 km northeast of the Çamurılıca. Its temperature is 62 ° C and flow rate is 2 L/sec. It is distinct with its sulfurous nature. Travertine is developed around the spring. They are classified Na>Ca>K by cations and HCO₃>Cl>SO₄ by anions.

Gümüşköy hot spring

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, but its flow rate is very low due to 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 500 m 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.

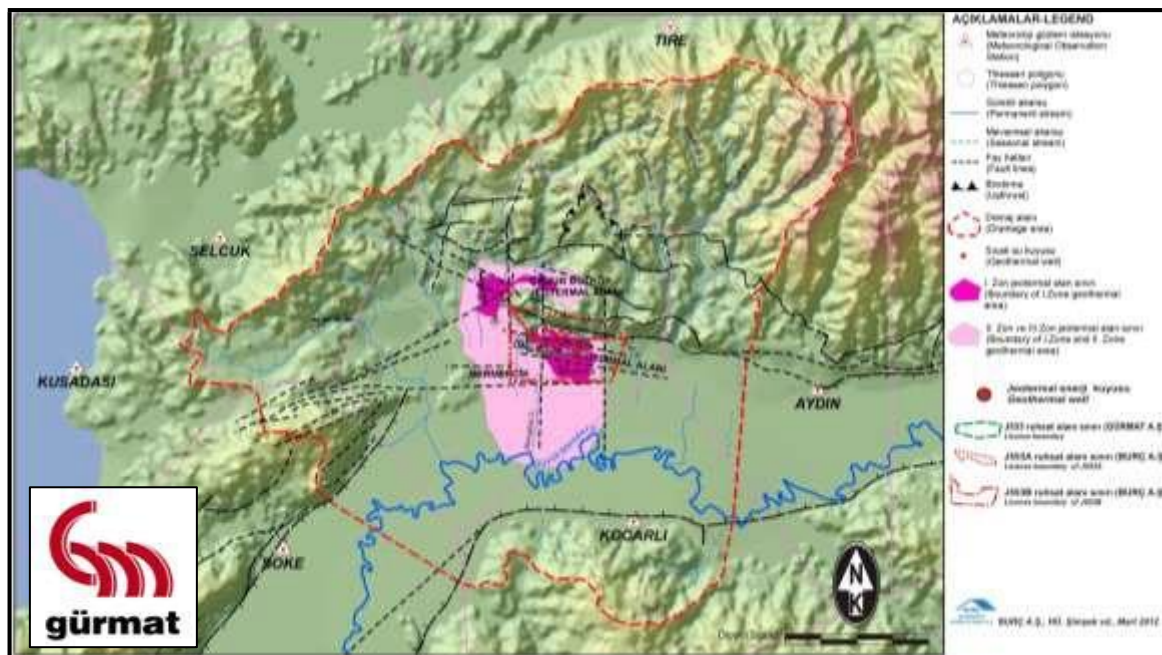


Figure 48. Feeding area of the licensed field no J-553

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. Dr. Şakir Şimşek, April, 2012

II.1.4. Hydrological characteristics (physical, chemical, bacteriological and ecological characteristics of surface water resources such as lakes, streams, and other wetlands, flow rates and seasonal variations of streams in this context, floods, classification of catchment basins as oligotrophic, mesotrophic, eutrophic, dystrophic, sedimentation, drainage, coastal ecosystems of all water resources)

The project site is located within the Büyük Menderes basin that is one of the separated water basins across Turkey.

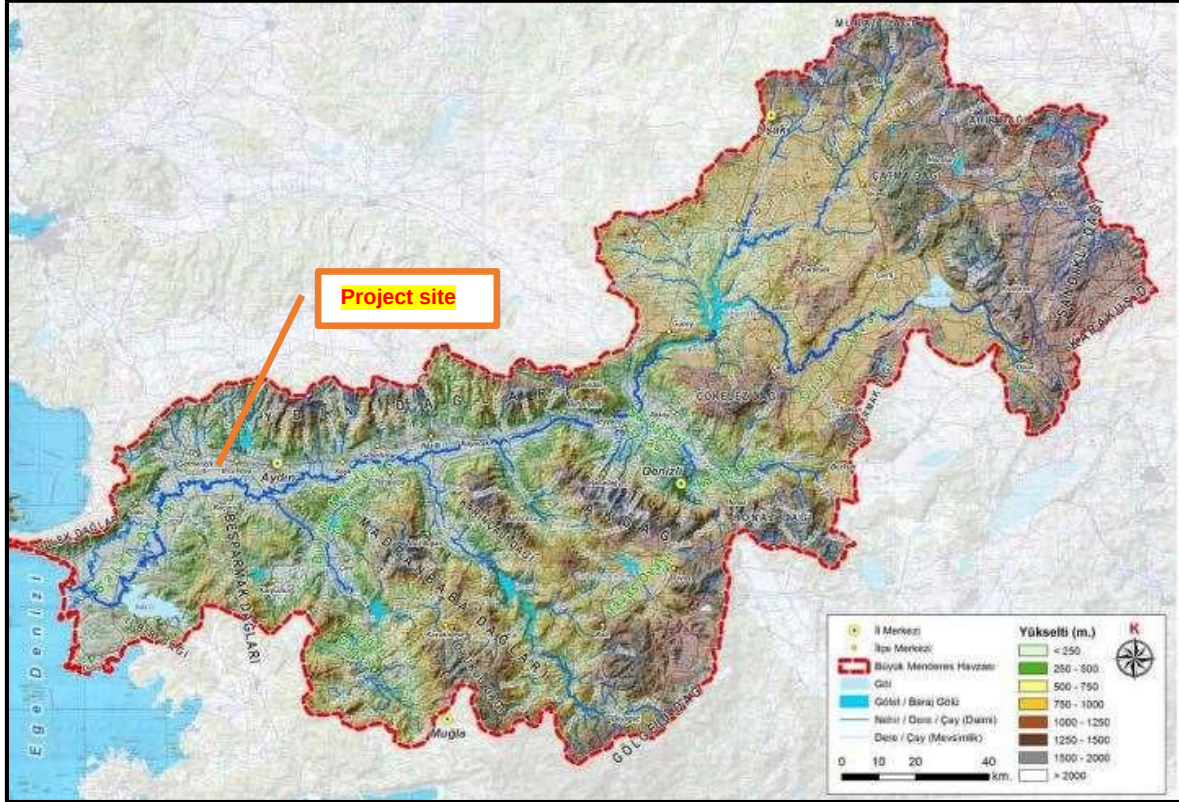


Figure 49. Topographical map of the Büyük Menderes Basin

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 Anatolia 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 reaches the Aegean Sea. The river is fed by numerous tributary creeks. The main 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 50. Lakes and streams within the 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, whereas 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 significantly modified water bodies.

As for the use of water throughout the basin, it can be concluded that water use for agricultural irrigation, urban (potable) 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 is also used for the hydroelectric power plants. Energy generation is carried out in Kemer HPP located on Akçay and Cindere HPP 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 rather for agricultural irrigation.

While 38% of irrigation needs is met by groundwater in Turkey, agricultural irrigation water is mainly provided from the streams in the 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 irrigated by dams, this percentage is 30% for Büyük Menderes.

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

The İkizdere Dam in the basin is currently used for the purpose of providing potable 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 potable water. (Büyük Menderes Action Plan for Basin Protection, 2010).

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

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

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

Streams¹¹

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 west of Söke. The main creeks connecting to this river are Alangüllü Brook, Kavaklı Creek, Oyuk Creek, Yalkı Creek, and Cılımbız Creek.

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 Anatolia 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 reaches the 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. 200 ha of agricultural land is covered with alluvium and 2,000 ha of land is flooded every year. The river is fed by numerous tributary creeks.

Dandalaz Creek

It is the outcome of waters gathered to the south-east of Karacasu. The name of its first part is Geyre Creek. Işıklar stream and Akyar stream coming the foothills of Babadağ joins it from the right. It flows into a plain in a pebbly and rocky bed, and joins to Büyük Menderes near Kuyucak.

Akçay

It rises in the mountains in the north-east of Muğla. It joins to Yenidere from the slopes facing to the Tavas plain. It begins to flow rapidly in narrow and deep valleys. Kemer Dam is constructed on it in advance of the plain level near Bozdoğan. It crosses the valley between Karıncalıdağ and Madran by flowing to north west. It joins to Büyük Menderes near Yenipazar.

¹¹ Environment status report 2015 for Aydın Province

Çine Creek

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

Other small streams

There are many creeks joining to Büyük Menderes within the boundaries of Aydın. These creeks from the right side are Feslek, Kestel, Malgaç, Köşk, Musluca, and İmamköy. Those joining from Aydın are Tabakhane Creek between Aydın and Germencik and Karagöz, Yalkı, İkizdere, and Alangüllü Creeks. Those creeks from the left side are Kocadere and Dalama creeks. The others are Çakırbeyli, Çakmar, Koçarlı and Sarıçay after Çine Creek.

Table 26. Streams in Aydın Province

Name of stream	Total length (Km)	Length in province boundaries (km)	Min flow (m ³ /sec.)	Max flow (m ³ /sec.)	Average flow	Stream of which it is a branch	Intended use
Büyük Menderes	584	293	1.000	700.0	80.55		
Çine Creek	359	143.9	0.000	625.0	10.70	Büyük Menderes	Irrigation, energy, and flood protection
Akçay creek	158	69.8	0.004	975.0	20.10	Büyük Menderes	Irrigation, energy, and flood protection
Köşk creek		23.1	0.000	170.0	1.070	Büyük Menderes	Irrigation
İkizdere creek		21.5	0.000	450.0	2.130	Büyük Menderes	Potable water supply
Dandalaz creek		44.5	0.001	250.0	2.270	Büyük Menderes	Irrigation and potable water supply
Kapızdere creek	17.9	17.9	0.000	150.0	0.661	Büyük Menderes	Irrigation
Sarıçay creek		47.7	0.000	419.0	1.590	Büyük Menderes	Potable water supply
Kargın creek			0.000	105.0	0.329	Büyük Menderes	Potable water supply
Cılmbız 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 potable water data supply
Madran creek	41.2	41.2	0.000	86.0	0.950	Büyük Menderes	Irrigation and flood protection

Source: Environment status report 2015 for Aydın Province

Natural lakes, ponds, and reservoirs¹²

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

Lake Bafa is an A-grade wetland. The lake has been taken under protection by being declared as a natural park on July 8, 1994. It is located on the 37°29' northern and 27°28' eastern coordinates. Gulf Latmos, which was once a bay of the Aegean Sea, was covered with alluvium carried by Menderes River and the gulf, approximately the 300- km², was filled in, and consequently today's Lake Bafa was formed. 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 also used as a place of nutrition and shelter by hundreds of thousands of ducks and aquatic birds in winter.

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 Lake Bafa and its altitude is 7 m.

Table 27. Existing irrigation ponds in Aydın Province and information about these ponds

Name of pond	Volume of lake	Irrigation area (ha)	Intended use
Akçaova pond	2.89	337	Irrigation
Hıdırbeyli pond	4.85	273	Irrigation
Çatak pond	1.96	160	Irrigation
Karacaören pond	0.64	-	Running water and drinking water
İbrahimkavağı pond	0.34	81	Irrigation
Gökçeburun pond	0.929	108	Irrigation
Kahvederesi pond	0.29	32	Irrigation
Kahvederesi-2 pond	0.145	22	Irrigation
Katrancı pond	0.86	223	Irrigation
Meriçler pond	1.22	21.5	Irrigation
Hamzabali pond	0.69	100	Irrigation

Source: Environment status report 2015 for Aydın Province

¹² Environment status report 2015 for Aydın Province

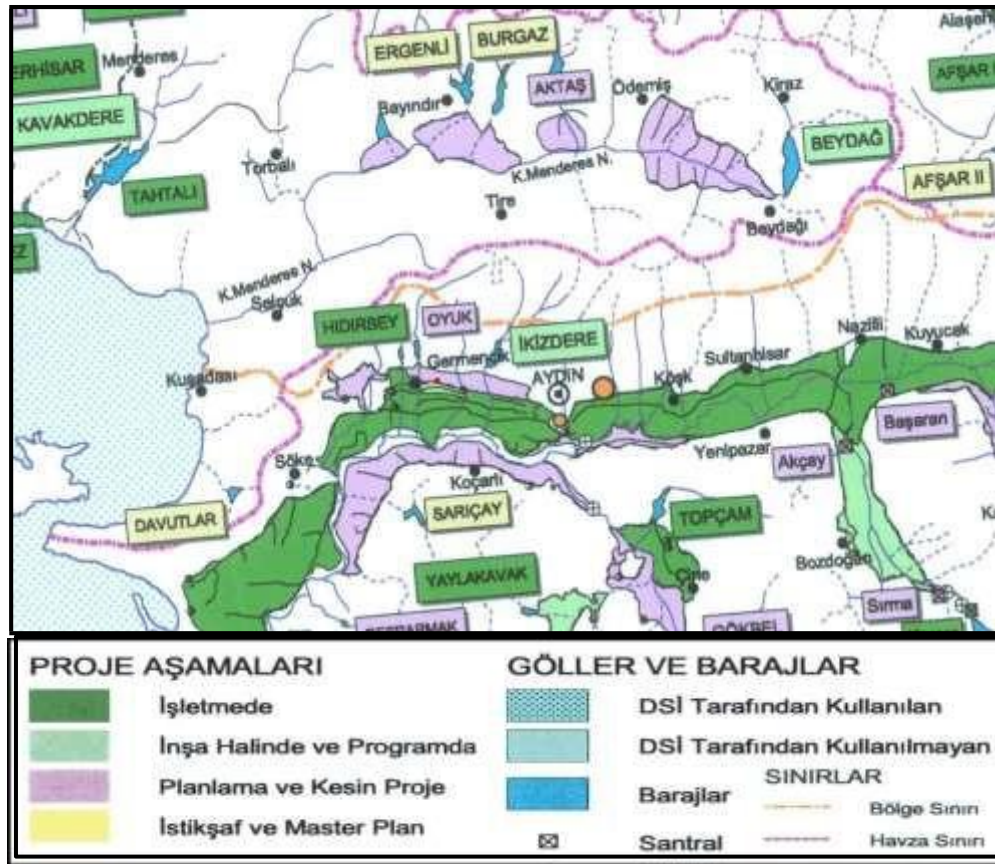


Figure 51. Current water utilization status of the project site and its surroundings, intended and existing irrigation facilities
Source: DSİ

Distance between the project site and Büyük Menderes river is 7 km, which is illustrated in Figure 52.



Figure 52. Map showing the project site and Büyük Menderes River
Source: Atlas Geographical Database of Turkish Ministry of Environment and Urbanization, January 2017.

Lake-Pond-Dam

The characteristics of lakes, ponds, and dams in Aydın province are given in the table below.

Table 28. Dams in Aydın Province, their areas of utilization and distances to the project site

Item no	Name of dam or HPP	Province-district	Purpose	Approximate distance to the project site
1	İkizdere Dam	Aydın- İncirliova	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+Anti-flood	61 km
5	Kemer Dam	Aydın- Bozdoğan	Irrigation+Flood+Energy	85 km

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

Table 29. Ponds in Aydın Province, their properties and distances to the project site

Item no	Name	Province-district	Purpose	Approximate distance to the project site
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	Running water+ drinking water for	35 km
6	Kahvederesi pond	Aydın -Karacasu	Irrigation	85 km

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

The pond closest to the project site is the Hıdırbeyli Pond located at an approximate distance of 6 km to the northwest.

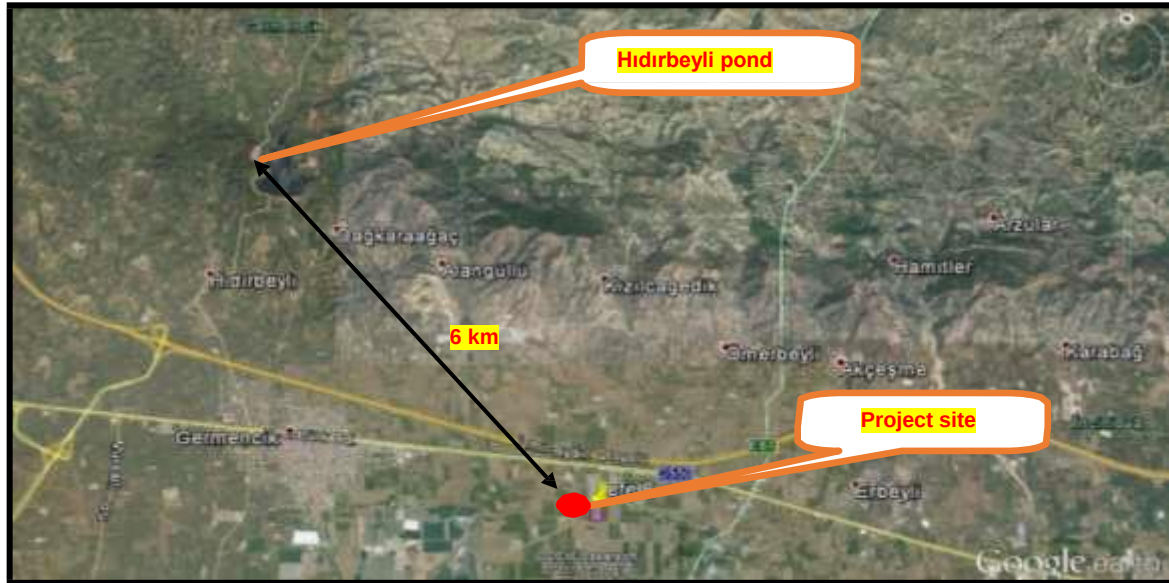


Figure 53. Satellite image showing the Hıdırbeyli pond within the project site

The dam closest to the project site is the İkizdere Dam located at an approximate distance of 9 km to the northeast.



Figure 54. Satellite image showing the İkizdere dam within the project site

Hydrological effects and measures to be taken within the scope of the project

No detonation will take place within the project site. 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 site, and no operations shall be carried out preventing the free flow of water.

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

Residential areas, surrounding lands and stream bed shall not be damaged during construction and operation activities, and DSİ shall not be held legally liable for any kind of damage, floods and water pollution problems resulting from any improper practices.

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-8 Geothermal Power Plant and other power plants existing in the licensed field as a whole. The monitoring wells will be drilled in such a way that the production and reinjection wells to be monitored according to the site distribution, and the monitoring wells will be insulated by closed pipes and cementing from the well mouth to the observation level. Limnigraph will be deployed in the wells, and temperature, ph, and ec monitoring data will be transmitted to DSİ Regional Directorate on a continuous basis. The approval of DSİ Regional Directorate for drilling the observation wells shall be obtained.

In the operation phase of Efe-8 GPP facility, which is planned to be installed and operated, if the intended geothermal power plant's pipelines, energy transmission lines etc., which are not registered in the name of State Hydraulic Works, are to be constructed and operated by State Hydraulic Works; a protocol including the transition conditions will be prepared and discussed with the DSİ Regional Directorate. In case the transitions related to the planned project are made through 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 will be prepared and submitted to the Regional Directorate of State Hydraulic Works (DSİ) before the construction phase of transitions. No construction activities shall be started for the transitions related to facilities under the responsibility of the DSİ without ensuring mutual agreement on the protocols regarding transition conditions and easement rights is established for the transitions requiring establishment of easement right.

During the construction and operation of the Efe-8 Geothermal Power Plant project, there shall be no intervention with the facilities of the State Hydraulic Works, and water transmission of the facilities of the State Hydraulic Works shall not be prevented.

During the works to be carried out within the scope of the project, the provisions of Law on Groundwater, Regulation 28257 on Protection of Groundwater from Pollution and Degradation dated April 7, 2012, and Regulation on Control of Water Pollution shall be complied with.

During the construction and operation phase of the project, material and waste shall not be dumped into the surrounding stream 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.1.5. Characteristics of geothermal source (potential and levels of geothermal source, relation with other geothermal sources in the region and with the basin)

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

Chemical properties of geothermal waters¹³

Geothermal fluids are renewable and environmentally friendly natural resources and are widely used by different countries today (İlgar, 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; İlgar, 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 of geothermal fluids 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; Küçüknane et. al., 2004; Gemici et. al., 2004).

¹³Alangüllü (Aydın) Jeotermal Kaynağının Kimyasal Özellikleri Ve Çevreye Olan Etkilerinin Uzaktan Algılama Ve CBS Kullanılarak Belirlenmesi, Emrah Aslan, İzmir, 2010

Thermal waters contact rocks along the environment they pass through and dissolve some substances due to their temperature and carry them together. 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. Circulation of 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 geothermal waters is also important for determining its environmental impacts on air, water, and soil due to its harmful content in case they are discharged to the environment. Although energy generation and heating systems, which are the main intended use of geothermal resources, are known as clean, they are not very clean due to liquid and gas content and substances in it discharged to the nature. Harmful effects of such substances must be determined, and control measures must be taken and analysis methods must be applied, if necessary.

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 geothermal systems, their feeding and discharge zones, and mixing ratios with other waters.

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. Temperature usually increases 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 -310-times higher than another environment with a temperature of 20 °C. The fact that rocks are more altered in high-temperature environments is the evidence of this. The results of the geothermal chemical analysis revealed that geothermal fluids contains 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), sulfate (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) are 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).

In the "Consultancy report on assessment of geological, hydrogeological, and geophysical potential of the fields under the Aydın-Germencik geothermal operating license and Production/ Reinjection Well Locations" prepared by Prof. Dr. Şakir ŞİMŞEK, the characteristics of the geothermal source have been specified, whereas the relevant data is in the following.

Physical properties of waters

The reservoir temperature is above 200 °C in the wells within the area. The maximum temperature measured in the ÖB-30 well is 239.51 °C. 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 area is characterized by a water-dominated high-temperature site.

The electrical conductivity (EC), which is an indicator of total ionic concentration of 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 boreholes during the tests. Accordingly, 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 $\text{Cl} > \text{HCO}_3 > \text{SO}_4$ and the cations are in the form of $\text{Na} + \text{K} > \text{Ca} > \text{Mg}$, and they are in the NaCl type of water. The ÖB-7 is in the NaHCO_3 water class.

Sample no	T (°C)	pH	EC (µS/cm)	Na	K	Ca	Mg	CO ₃	HCO ₃	Cl	SO ₄	B	SiO ₂	Dominant cation ranking	Dominant anion ranking
ÖB-1*	203	7.21	6500	1440	60	50	1	0	1140.2	1595.3	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	1669	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, 1988-2005 **GÜRMAT, 2006-2010 ***MTA, 2008 ****MTA, 2011

Figure 55. Results of the chemical analysis on water samples from borehole within the Germencik geothermal field (concentration unit is Ppm)

Origin characteristic of waters

Semi-logarithmic Schoeller and Piper diagrams were created in order to illustrate 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 waters are characterized by Na-Cl (salty water), and their clustering almost in the same area indicates the similarity of the geothermal reservoirs. In the semi-logarithmic (Schoeller) diagram for the boreholes 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.1.6. Other geothermal sources in the region and their utilization status(energy, tourism, heating, greenhouse cultivation, etc.)

Aydın province has the richest geothermal fields in Turkey ever. Approximately 70% of the national geothermal potential is within the depression area called Büyük Menderes Graben between the districts Aydın-Ortaklar and Denizli-Sarayköy.

The studies carried out in the region were elaborated separately for each site and compiled as the Inventory of Geothermal Sites in Aydın Province within the scope of the efforts to create a Geothermal Energy Inventory by the General Directorate of MTA. In addition to the existing inventory data, the Geothermal Sites Inventory of Aydın Province has been updated by new data obtained by means of activity reports on the fields licensed by the special provincial administration of Aydın province.

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

The geothermal sites and their features in the region are compiled in Figure 56.

NAME OF GEOTHERMAL SITE	NAME OF NATURAL HOT WATER OUTLET	NATURAL OUTLET			DRILLING			AREA OF USE	ERECTED FACILITY	DEĞ. BEL.
		Temp. (°C)	Flow R. (l/sec)	Potential (MWt)	Temp. (°C)	Flow R. (l/sec)	Potential (MWt)			
YILMAZKÖY	Ilıcabaşı	34-38	1,1		84-142	47	19	Hot springs or heating hot spring facilities	-	***
GERMENCİK- ÖMERBEYLİ	Ömerbeyli Sahası				203- 232	725	594,83	Electricity generation, and other implementations depending on reinjection wells, urban heating-cooling, greenhouse heating, fruit drying (fig, grape), textile industry (yardn), cold storage, hot springs or heating hot spring facilities	-	***
BOZKÖY-ÇAMUR	Bozköy-Çamur	36-92	4		59-142	280	107	Hot springs or heating hot spring facilities	Hot spring	***
SALAVATLI	Salavatlı				167- 172	93,8	53,79	Electricity generation and other implementations depending on reinjection wells, urban heating and cooling, greenhouse heating, fruit drying, industrial process heating, hot springs or heating hot spring facilities	Hot spring	***
SULTANHISAR	Sultanhisar				145- 146	200	89			
MALGAÇEMİR- GÜVENDİK	Güvendik	38	0,5					Thermal tourism		
ORTAKLAR-GÜMÜŞ	38,7							Hot springs, hot spring facilities and greenhouse heating	Hot spring	***
SÖKE-SAZLIKÖY	Sazlıköy	27								
KUŞADASI	Ilıca	-	-	-	26	3	-	Hot springs, hot spring facilities and greenhouse heating	-	**
BUHARKENT- ORTAKÇI	Ortakçı	51	0,3		-	-				**
NAZILLI-GEDİK	Gedik	32	-		36	1	1			**
DAVUTLAR	Davutlar-Karina	26-42	-							**
UMURLU- SERCEKÖY					124- 155	116	143			**
ATÇA					63-124	95	35			
PAMUKÖREN					188	58	37			
ÇİFTLİK	-	-	-	-	58	35	3,37	Heating, thermal tourism		

* MTA, 1996. Geothermal inventory of Turkey

** MTA, 2005. Geothermal sources inventory of Turkey

*** DPT, 2001. Mining specialization commission of the 8th five-year development plan, Sub-commission for energy raw materials, Report of geothermal energy work group

Note: Potentials in drillings have been calculated according to the total of initial production flow rates of the wells
Calculated according to

1. the total of initial production flow rates of the wells

2. the reservoir temperature in high-temperature (higher than 100 °C) fields

Figure 56. Geothermal source fields in Aydın Province

Source: Mineral Research and Exploration

The sites suitable for generating electrical energy by reservoir temperature in the Aegean region are given in Table 30.

Table 30. Geothermal areas suitable for power generation depending on reservoir temperature

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

II.1.7. Current and planned use of surface water resources, their basin feature, if any(potable water, running water, irrigation water, power generation, aquaculture production and product types in dams, lakes, and ponds, waterway access facilities, water and/or coastal uses for tourism, sports 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 west of Söke. The main creeks connecting to this river are Alangüllü Brook, Kavaklı Creek, Oyuk Creek, Yalkı Creek, and Cılımbız Creek.

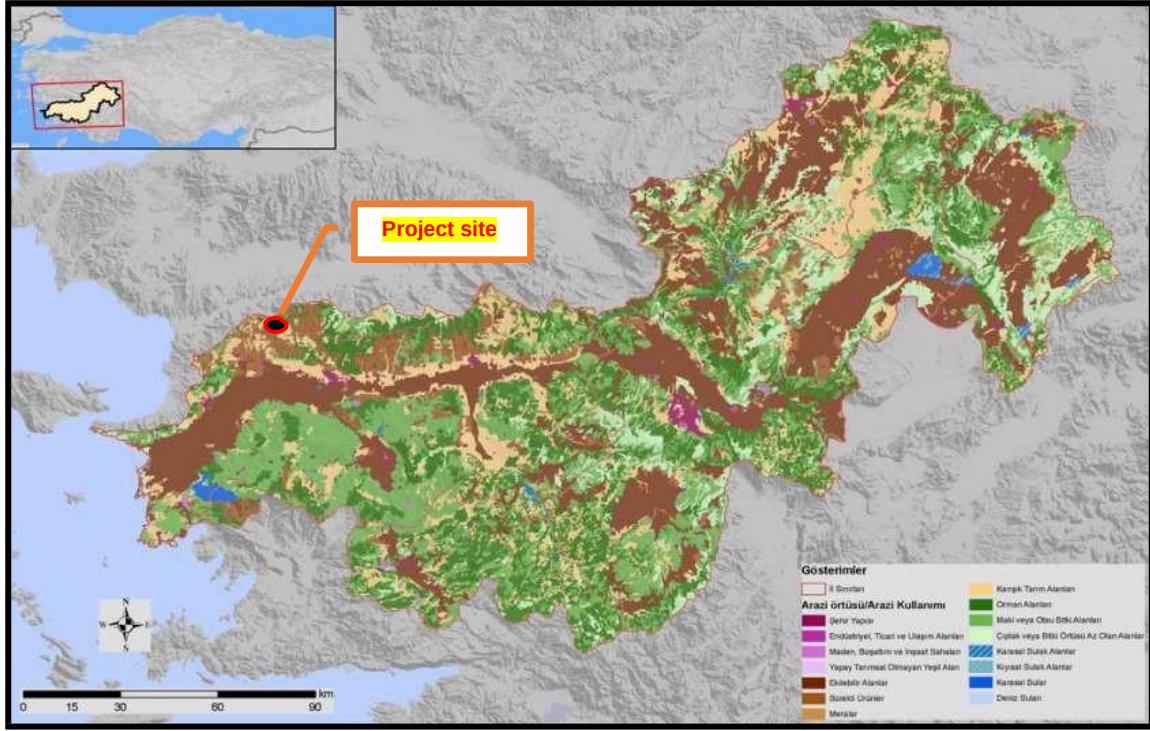


Figure 57. Büyük Menderes basin

The stream closest to the project site is the Büyük Menderes River located at an approximate distance of 7 km to the south.

The pond closest to the project site is the Hıdırbeyli Pond located at an approximate distance of 6 km to the northwest.

The dam closest to the project site is the İkizdere Dam located at an approximate distance of 9 km to the northeast.

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

II.1.8. Soil characteristics and use status (soil's structure, land use capability, classification, bearing capacity, slope stability, slipperiness, erosion, use for earthworks, natural vegetation used as pasture, meadow etc.)

Various types of soil are encountered in Turkey due to high diversity of climate, different structures of bedrocks in the fields, diversity of vegetation, the elevations and differences in ground patterns. Main types of soil types are detailed in Table 31.

Table 31. Soil types encountered in Turkey

Alluvial soils	These are soils formed by accumulation in places where slope decreases of materials such as sand, alluvium, clay and gravel eroded by the rivers and flood waters. This type of soil is generally encountered in streams, valleys and plain bases, in the alluvial cones where the slope decreases and deltas. These soils which are extremely fertile, therefore very important for the national agricultural economy.
Terra rossa	These soils formed in the areas covered with limestones in the Mediterranean climate are red in color. It is mostly encountered in the Mediterranean Region of our country.
Brown forest soils	This type of soils were developed especially in the areas covered by broadleaf forests of the Black Sea and Mediterranean regions. These soils are rich in humus and are fertile.
Podzolic soils	They are pale colored and infertile soil widely encountered in coniferous forests in the Western Black Sea region.
Lateritic soil	Soils resembling laterite are encountered in the coastal part of the Eastern Black Sea Region resembling the hot and rainy climate of the equatorial region.
Chestnut and brown steppe soil	These soils pertaining to steppes with little rainfall are encountered particularly in Central Anatolia, Southeast Anatolia, and Eastern Anatolia. They are usually user for grain farming.
Chernozem	These soils seen in Erzurum - Kars plateaus are rich in humus since they develop under lush grasslands formed by summer precipitation. They are dark in color for this reason.
Salty soils	Encountered around Lake Tuz, these soils are infertile.

The map of general soil types in Turkey is given in Figure 58.

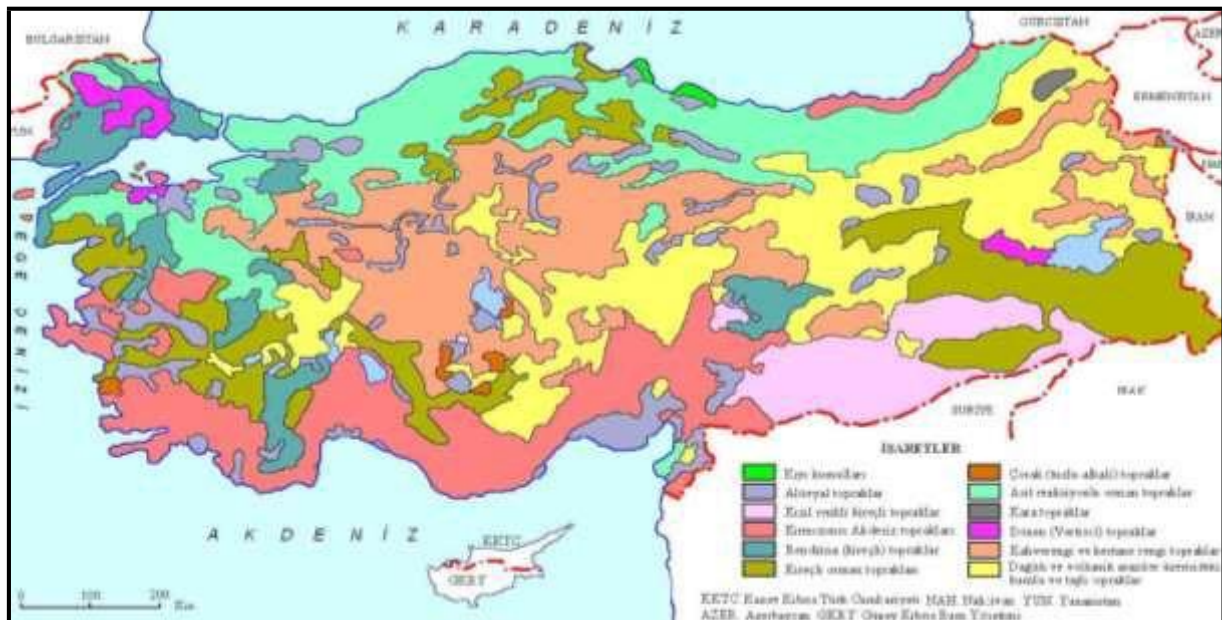


Figure 58. General soil types map of Turkey

Soil¹⁴

Aydın Province has extensive agricultural lands irrigated with Büyük Menderes River. The and close to the Büyük Menderes River is generally composed of 1st class and Alluvial soils. This fertile land extends westward from the boundaries 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 the districts Nazilli, Sultanhisar, Köşk, İncirliova, Koçarlı, Germencik, and Söke. 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. These soils are classified in the upper category according to 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.

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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 some mineral layers (A) of different characteristics are found C profiles. Materials forming these soils are carried in a perched state and stored by streams. Mineral compositions are heterogeneous and are continuously or seasonally damp, they are mostly under the influence of ground water. Mild lime wash 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 upland soils.

The color of such a soil depends on the substances it contains. 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 exposed to floods.

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 grayish 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 also be present under it.

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

Red Mediterranean Soils (T): The most prominent characteristics of these soils is that its entire profile is tile red color and the organic matter in the upper soil is rare. Soil carbonates are only composed of washed heavy clay. Horizon A has very uniform red color. 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 an ABC profile. Horizon A has a well-developed medium organic substance and organic substance and mineral substance are thoroughly mixed. A weak horizon A can be seen. 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 color 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, grayish 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 lime-washed, 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. Their 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. CaCO_3 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, or 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.

Soil structure of Aydın Province¹⁵

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% have neutral reaction (pH 6.6-7.5), and 58.1% have alkaline reaction (pH greater than 7.5).

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

¹⁵ Environment status report 2011 for Aydın Province

Lime in the Soil (CaCO_3): In Aydın province 34.5% of agricultural lands are slightly calcareous, 20.4% are moderately calcareous, 22.67% is calcareous, 17.6% is very calcareous, and 4.97% is heavily 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 moderate and 16.8% were rich. According to this assessment, phosphorus deficient soils should be reinforced with phosphorus fertilizers.

Potassium: Geological structure and climatic conditions cause excessive accumulation of potassium in soils. 0.17% of the land of the province has low, 2.7% has moderate, 3.9% has sufficient, 93.3% has excessive amount of potassium.

Soil structure of the project site and classification of land use capability

1/25,000-scale land asset map including the EIA area within the scope of the intended project is given in Annex-3. Information on the characteristics of the EIA area based on the land assets map is detailed below.

The project site is mainly located in Class II soil groups according to the Land Assets Map provided in Annex-3.

According to the Land Assets Map provided in Annex-3, the project site exists within the irrigated agricultural area (S) in terms of land use and within alluvial lands (A) in terms major soil groups.

Erosion:

The soil within the project site is characterized by a shallow, very shallow and lithosolic structure, and it is subject to severe and very severe water erosion in terms of degree of erosion.

There is no creek with continuous flow within the project site. However, there are stream beds that show temporary flow depending 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 classified as water and wind erosion:

Wind Erosion: It is the phenomenon of transportation of the soil due to severe and strong wind. As a result of the wind erosion, fertile soil disappears, soil moisture decreases due to the acceleration of evaporation, plant growth slows down, and 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, erosion can be categorized into 5 groups as follows:

- Splash erosion
- Sheet erosion
- Rill erosion
- Gully erosion
- 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 just starts. Diameter of a raindrop is also directly proportional to the damage it causes.

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 increases with the continuation of the runoff, 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 bigger than the rills come into existence and this is called gully erosion.

Erosion caused by stream beds: Streams erodes their beds in depth and transversely, and this type of erosion is called "Erosion caused by stream beds". Eroding depends on the flow rate of the stream.

Wind erosion, splash erosion and sheet erosion are the most common erosion types in the project site.

Based on these principles, necessary measures shall be taken in the operation site to combat erosion during the energy generation phase.

During the operation; the relevant provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" promulgated in Official Gazette issue number 27605 dated 08.06.2010 shall be observed.

II.1.9. Agricultural areas (whether there are agricultural areas or not, if any, agricultural development project areas, sizes of irrigated and dry agricultural lands, product patterns and their annual production quantities, role of products in national agriculture and their economic value)

Agriculture and livestock sector in Aydın province, having one of the largest cultivation areas in Turkey in terms of regional surface area, has recently started to become apparent across the country in terms of product diversity as well. Among the factors leading to this are that the terrain is not too hilly, presence of wide plains and the widespread use of mechanized 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 province is also engaged in agriculture, so 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 the industry and trade sector. 90% of the production of industrial facilities 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

Table 32. Agricultural areas and number of farmers

Parameter	Surface area
Total agricultural area (2015)	3,681,002 da
Number of farmers registered to the Farmer Registration System (2015)	51,009
Lans assets registered to the Farmer Registration System (2015)	2,567,479 da

Table 33. Distribution and production amounts of agricultural areas

Parameter	Surface area	2015 production (tons)
Field crops	1,379,845	2,580,000
Fruits	2,156,419	761,000
Vegetables	108,173	343,000

Table 34. Field crops data

Parameter	2015 production (tons)
Maize (green-silage)	1,040,328
Green grass	900,432
Cotton	287,473
Maize (grain)	147,666
Wheat	75,087

Table 35. Fruit growing data

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

Table 36. Vegetable growing data

Parameter	2015 production (tons)
Tomato	149,977
Melon	65,451
Pepper	27,951
Cantaloupe	14,162
Eggplant	12,779

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

Table 37. Agriculture and Agricultural Industry

Parameter	Quanti	Parameter	Quanti
Milk and milk products	197	Production of bread and bread types	309
Meat and meat products	21	Production of pasta and semolina	-
Aquaculture processing	-	Egg packaging	16
Fruit-vegetable processing-packaging	199	Frozen food	-
Production of cereals and pulses	2	Convenience food, fixed-menu food	47
Solid and liquid vegetable oil	3	Ready-made soup and bouillon, pudding, powder mixtures, mayonnaise, sauce etc.	-
Sugared products	39	Nuts and appetizers	38
Olive oil	2	Spice processing	29
Canned food and paste	-	Soft drinks	10
Production of fermented and pickled products	55	Alcoholic beverages	4
Production of pastry products	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 similar products	2	Substances in contact with food	6
Production of flour	3	Forage	331
Production of bakery products	77	Others	6

II.1.10. Forest areas (forest area amounts, tree species and quantities in these areas and surface areas covered by these species, closure and characteristics of such areas, current and planned protection and/or use purposes, if the project site is not a forest area, distance of the project site and units to the closest forest area, 1/25,000-scale stand map)

About 36% (326,649 hectares) of the province of Aydın is covered with forests, but forestry activities are underdeveloped. Having about 154 villages within or adjacent to forests, only 2% of the active population in the forestry sector in Aydın uses forestry sector. Nevertheless, nearly 3.8% of forestry income of Turkey is supplied from Aydın.

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

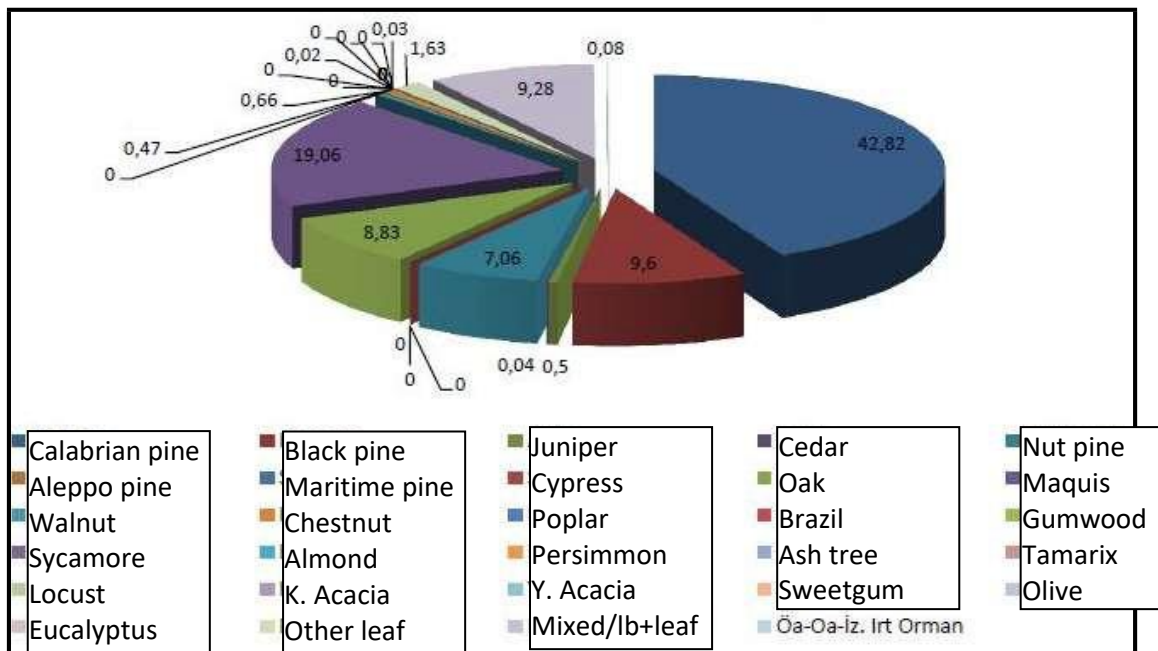


Figure 59. Tree species in Aydın Province

¹⁷ Environment status report 2011 for Aydın Province

The intended project is not within the forest lands. In Figure 56, locations of forest areas closest to the project site are illustrated. There is a forest land 1.5 km southeast of the project site.

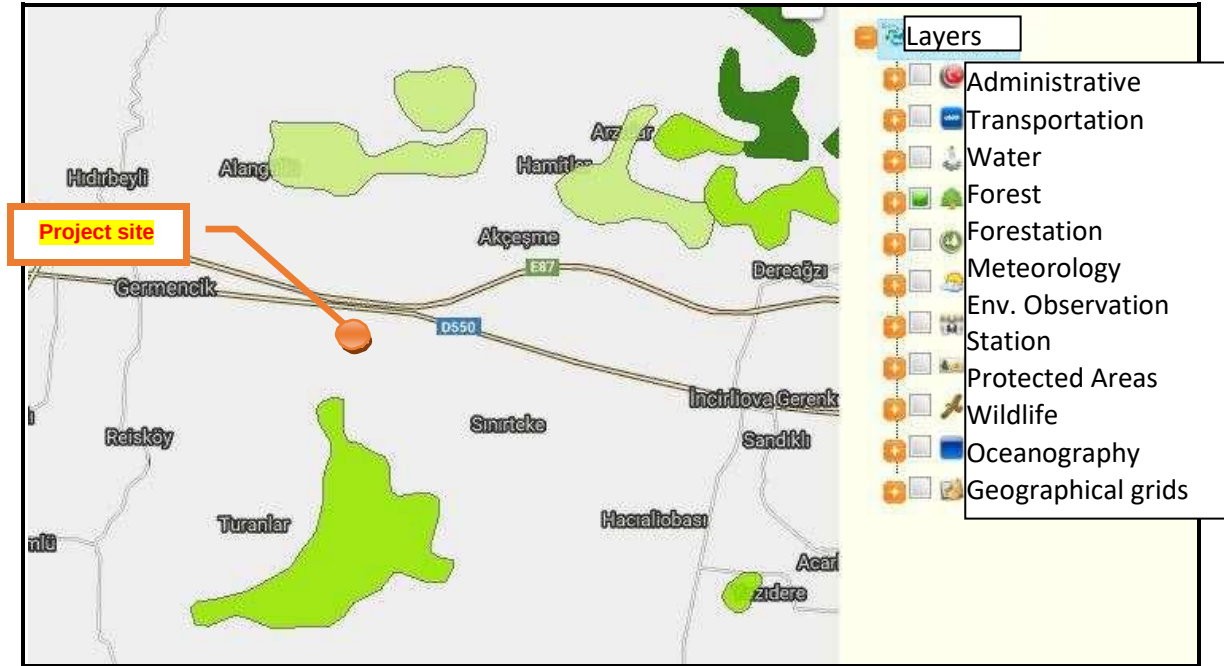


Figure 60. Project site and the closest forest lands

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

The project site is within "agricultural lands" and "irrigation areas" according to the 1/100,000-scale Environmental Plan of Aydın-Muğla-Denizli region. There are no areas identified as areas to be conserved or subject to construction ban within the project site.

Considering the 1/25,000-scale Land Assets Map prepared for the Efe-8 Geothermal Power Plant Project and presented in Annex-3, the project site is within an irrigated agricultural (S) area.

II.1.11. Protected areas (national parks, natural parks, wetlands, natural monuments, nature reserve areas, wildlife protection areas, biogenetic reserve areas, biosphere reserves, natural sites and monuments, historical, cultural sites, special environmental protection zones, special environmental protection areas, touristic areas and tourist attractions, areas covered by the pasture law, distance of the project to protected areas on a 1/100,000-scale map shown clearly and colorfully)

The assessment of the Efe-8 Geothermal Power Plant of the project site and its immediate vicinity carried out by observing the List of Sensitive Regions Annex-V to the Regulation on Environmental Impact Assessment is as follows.

1. Areas to be protected pursuant to national legislation

a) "National Parks", "Nature Parks", "Natural Monuments" and "Nature Reserve Areas" defined in Article 2 of the National Parks Law and determined pursuant to Article 3 of this 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 61. National parks in Turkey

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

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

The only national park in Aydın province, where the Efe-8 GPP project is located, is the National Park of Dilek Peninsula - Büyük Menderes Delta in Kuşadası district and its distance to the project site is nearly 39 km.

Table 38. National parks within the boundaries of Aydın Province

Province	District	Name	Surface area (decares)	Date	Distance to the project
Aydın	Kuşadası	National Park of Dilek P - Büyük Menderes D.	275,981.62	1996	39 km

Source: General directorate for nature conservation and national parks, <http://www.milliparklar.gov.tr/mp/mp.pdf>, January, 2017. Source: MAK 2016-2017.



Figure 62. Satellite image showing the project site and the national park within the boundaries of Aydın Province

Natural Park (NP)

According to the resolutions of the Central Hunting Commission (CHC) 2016- 2017, there are 4 natural parks within the boundaries of Aydın Province, where the project to be implemented. These natural parks are listed in the table below, and they are not affected adversely thanks to their distance to the project site.

Table 39. Natural parks within the boundaries of Aydın Province

Province	District	Regional Directorate	Name	Surface area (decares)	Date	Distance to the project
Aydın	Söke	4th Regional Directorate	Lake Bafa	118,420.73	1994	37 km
Aydın	Didim	4th Regional Directorate	Tavşanburnu	117.34	2011	62 km
Aydın	Çine	4th Regional Directorate	Şarlan	370.29	2014	52 km
Aydın	Karacasu	4th Regional Directorate (Manisa)	Çağlayan	380.43	2014	76 km

Source: General directorate for nature conservation and national parks, <http://www.milliparklar.gov.tr/belge/tp.pdf>, January, 2017. Source: CHC 2016-2017

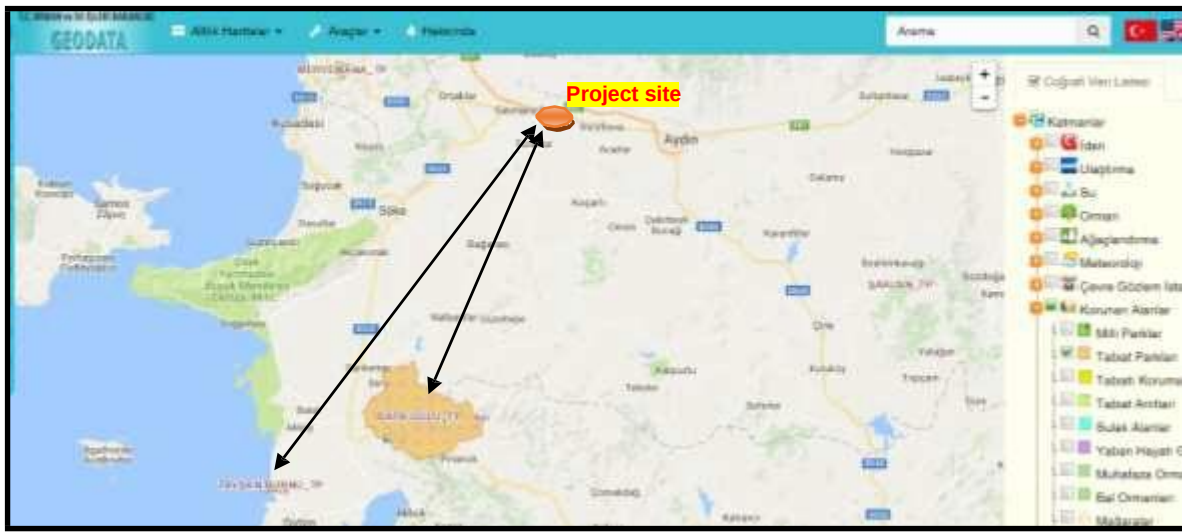


Figure 63. Map-1 showing the project site and the natural parks within the boundaries of Aydın Province
Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

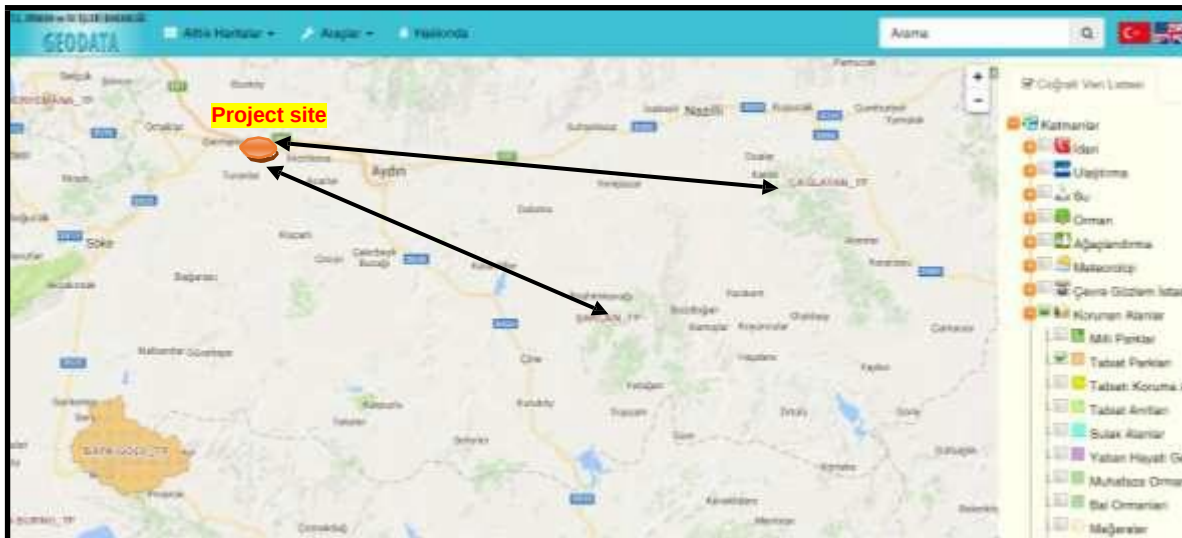


Figure 64. Map-2 showing the project site and the natural parks within the boundaries of Aydın Province
Source: Ministry of Forestry and Water Affairs, <http://geodata.ormansu.gov.tr/>, January, 2017.

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 within the boundaries of Aydın Province where the project will be implemented. Therefore, there is no natural monument in the project site and its immediate vicinity.

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

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

There is no Wildlife Development Areas within the boundaries of Aydın Province, where the project will be implemented, according to the 2016-2017 CHC resolutions. There is 1 wild animal placement area in the province. The area is located within the boundaries of Çine district and is approximately 30 km to the project site.

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 65. Map showing the project site and the wildlife areas within the boundaries of Aydın Province

Source: General directorate for nature conservation and national parks, <https://avlakharitalari.ormansu.gov.tr>, January, 2017.



Figure 66. Map showing the project site and the wildlife areas within the boundaries of 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-scale Environmental Plan of the Aydın-Muğla-Denizli Planning Region given in Annex-2, there are no protected areas or conservation areas in the project site.

Furthermore, in the opinion no. 4922 of the Directorate of Conservation of Regional Cultural Assets dated 22.12.2016 given in Annex-14, it is stated that there is no registered protected area or structure in the Efe-8 Geothermal Power Plant project (2*25=50Mwe) 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 site; there is no Aquaculture and Reproduction Area subject to the Fisheries Law no. 1380 dated 22.3.1971.

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

The dam closest to the project site is the İkizdere Dam located at an approximate distance of 9 km to the northeast.

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



Figure 67. Map showing the project site and the buffer zone of İkizdere Dam

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



Figure 68. Satellite image showing the project site and İkizdere dam, which is the closest dam

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

There is no area subject to the title "Critical Pollution Areas" defined in Article 49 of the Abrogated Regulation on Protection of Air Quality promulgated in the Official Gazette issue no. 19269 dated 02.11.1986 within the project site 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-8 GPP project is located.



Figure 69. Special environmental protection 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 subject to the title "Area Under Protection" according to Bosphorus Law no. 2960 dated 18.11.1983 within the project site and its vicinity.

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

The activity, which is the subject of the project, is planned to be carried out on the 36,705.33-m² area composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm (see Annex-10).

There are no forest areas within the project site.

h) Areas under construction ban pursuant to the Coastal Law

There is no area subject to construction ban according to Coastal Law no. 3621 dated 04.04.1990 within the project site and its vicinity.

i) 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 site.

i) Areas specified in Pasture Law

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

j) Areas specified in the Regulation on Protection of Wetlands

There are 14 Ramsar Site in Turkey, but there is no Ramsar Site in Aydın Province where the project will be implemented. Lake Bafa and Büyük Menderes Delta are wetlands, but they will not be affected adversely due to their distances to project site.



Figure 70. Map showing the project site and the wetlands in Aydın Province

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

2. Areas to be protected pursuant to international conventions

a) "Mediterranean Monk Seal and Reproduction Areas, Protection Regions I and II 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 is no area subject to the title "Mediterranean Monk Seal and Reproduction Areas, Protection Regions I and II 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)" promulgated in Official Gazette issue no. 18318 dated 20.02.1984 within the project site.

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

The project site has nothing to do 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 site.

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

The project site contains no area 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.

iii) 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 site 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 site.

ç) 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 site.

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 site 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 site is in an agricultural land according to 1/100,000-scale Environmental Plan of the Aydın-Muğla-Denizli Region. There are no areas identified as areas to be conserved or subject to construction ban within the project site.

b) Agricultural areas: Agricultural development areas, irrigated areas, irrigable areas, areas with land use capability classes I, II, III and IV, areas depending on rainfall for agriculture classes I and II and all special crop plantation areas

Considering the 1/25,000-scale Land Assets Map prepared for the Efe-8 Geothermal Power Plant Project and presented in Annex-3, the project site is within 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 6 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 intended project site.

In order to prevent environmental pollution on 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, streams, groundwater operation sites

There are no streams, dams, lakes, or ponds in the project site.



Figure 71. Map showing the project site and the dams, lakes, ponds and streams within 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 probably endangered 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 site or its immediate vicinity, there are no areas which are important for scientific researches and/or endangered or probably endangered 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.

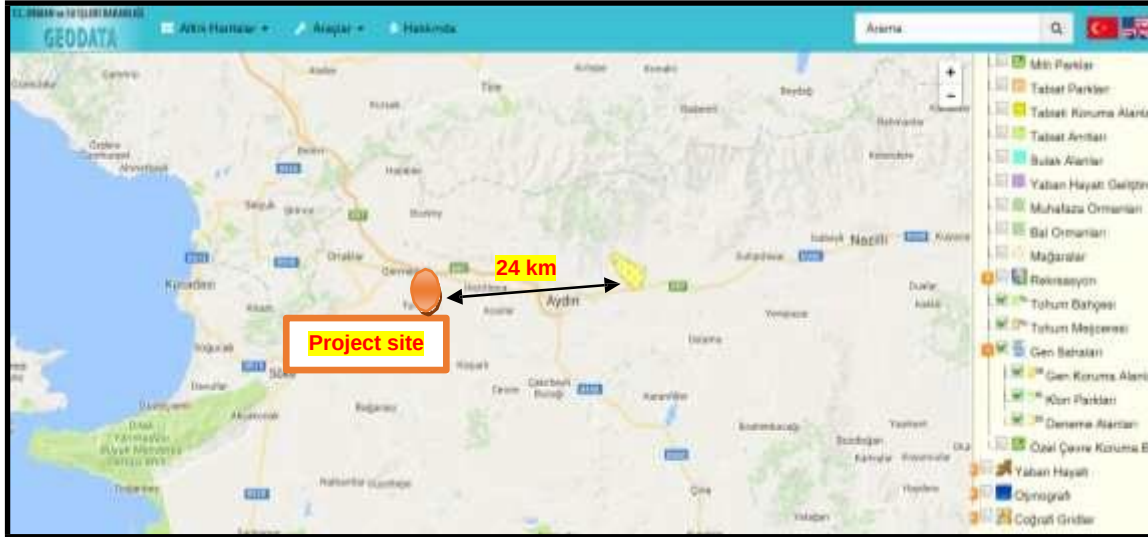


Figure 72. Map showing the project site and the gene fields and seed areas within its vicinity

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

II.1.12. Flora and fauna (species, endemic species, particularly endemic plant species, animal species that live naturally in the area, species protected by national and international legislation, rare and endangered species and their locations in the area, their distributions in the region, endemism statuses, abundance, names and populations of hunting animals and decisions taken by the Central Hunting Commission for these animals, information on who identified each species at what time and by which method (use of literature-current sources, observation, etc.), Collins Bird Guide, book of Important Bird Areas in Turkey, Book of Important Natural Areas in Turkey, IUCN, Bern Convention, CHC Resolutions, status according international treaties such as CITES, how the species will be affected by the project, illustration of vegetation types in the project site on a map, protective measures to be taken for the creatures to be affected by the project and works (during construction and operation phases), performance of fauna works during the vegetation period and indication of this period, control by using Turkish Plants Data Service (TÜBİVES) for flora

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 the Conservation of Nature and Natural Resources) is the red list of endangered species and the most comprehensive inventory of global protection status of plant and 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 definitive criteria for evaluating the extinction risk of thousands of species and subspecies. These criteria 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.

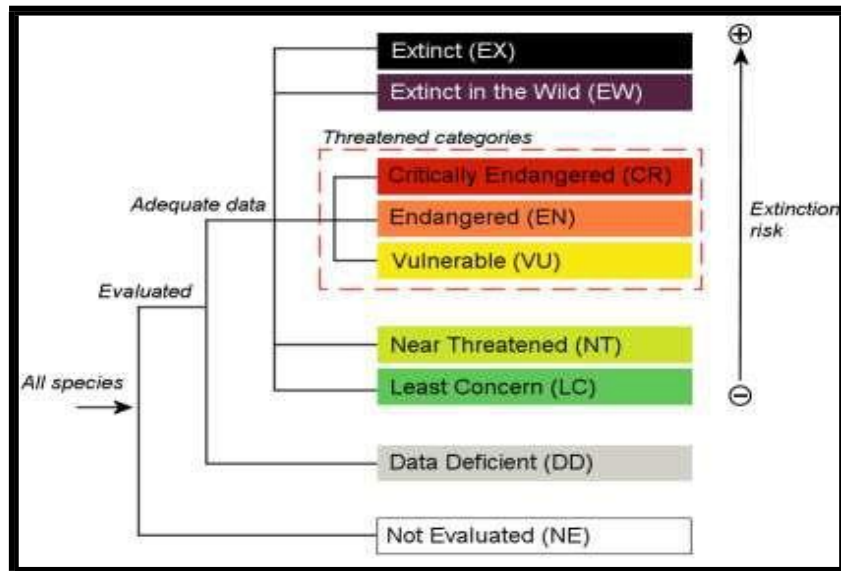


Figure 73. IUCN RED List categories Source: www.iucnredlist.org

Table 40. IUCN RED List categories and their meanings in Turkish

Category	Turkish meaning
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 41. Red Data Book categories according to Prof. Dr. Ali Demirsoy'a (1996)

Category	Abbrevia	Turkish meaning
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 in Annex-I: Flora species taken under strict protection.

List in Annex-II: Fauna species taken under strict protection.

List in Annex-III: Protected fauna species.

• RESOLUTIONS OF CENTRAL HUNTING COMMISSION (CHC) FOR HUNTING SEASON

The lists of the resolutions of Central Hunting Commission for hunting season 2016-2017 promulgated in the Official Gazette by the General Directorate for Nature Conservation and National Parks of Turkish Ministry of Forestry and Water Affairs 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",
- Literature studies published in relation to Flora of Turkey,
- TÜBİVES Plant Data Service,
- Data prepared during the preparation of many projects in the region. .

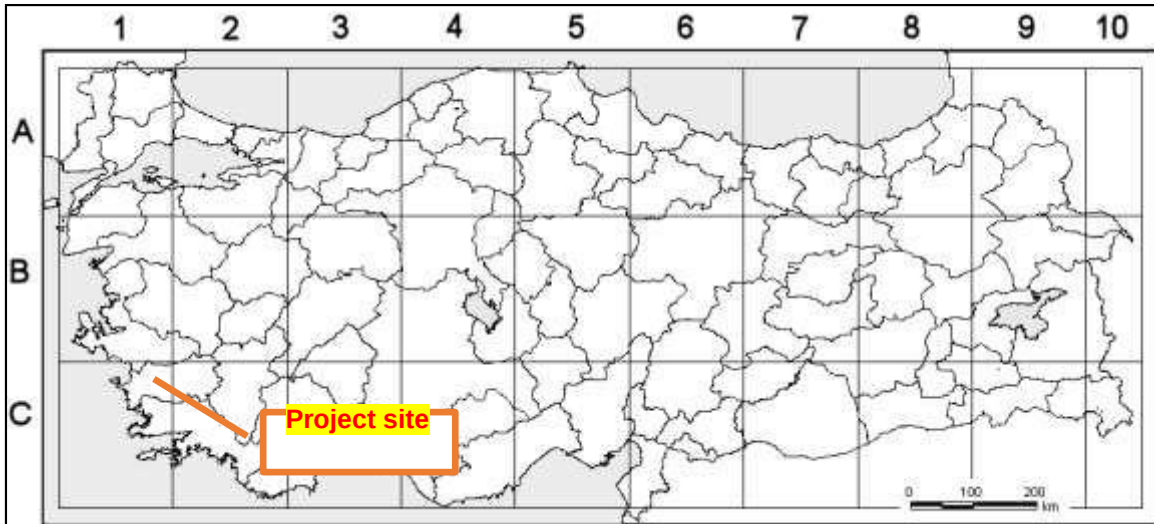


Figure 74. P. H Davis Grid System

- Distribution of flora species by phytogeographical region

Turkey is completely within the Holarctic Kingdom (Palearctic and Nearctic realm) in terms of plant geography. 3 floristic realms of Holarctic Kingdom are united in Turkey. These are as follows:

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

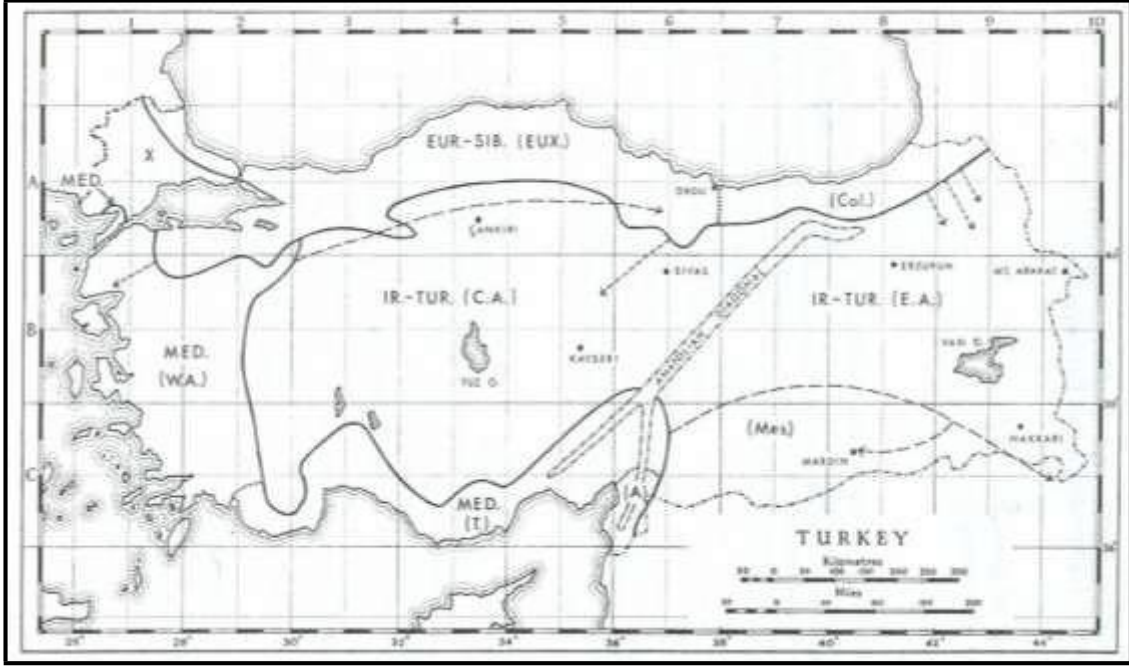


Figure 75. Phytogeographic regions of Turkey

Source: PH Davis' map



Figure 76. Floristic general view of the intended project site

The intended project is located in Aydın Province. Aydın Province is located in the phytogeographical region of MED (WA) /Mediterranean Region (Western Anatolia 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 boundaries 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 Gelibolu 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 Amanus 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 maquis, the real Mediterranean vegetation, it is called Black sea maquis.

The vegetation of the Aegean Region exhibits a rich variety. It contains distinctive groups of semi-alpine plant populations in the peaks of high mountains such as Kazdağı, Bozdağ, Muratdağı, Nif mountain, Spil Mountain, Akdağ, 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 temperature 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. In 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*), arbutas (*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 is composed of small hard-skinned leaves, 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 stream 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 42. Flora species with high probability of existing within the project site and its surroundings

Tribe	Species name in Latin	English name	HABITAT	Altitude (m)	Distribution in Turkey	Phytogeographical region	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 orchards	30-600	SW. Anatolia	Mediterranean	2	-	-				X	L
VITACEAE	<i>Vitis vinifera</i>	Common Grape Vine	Cultivation Areas (Vineyards, gardens, 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 (Vineyards, gardens, 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 fields, cultivated fields, sandy fields	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>		Fields, limestone slopes, Pinus forests	0-400	W. Turkey	Mediterranean	2	-	-				X	L
	<i>Notobasis syriaca</i>		Limestone rocky slopes, fallow fields, edges, roadsides	0-850	NW. Turkey, W., and E. Anatolia (S. end)	Mediterranean	3	-	-				X	L
	<i>Anthemis pseudocotula</i>		Stony slopes, fields, roadsides	0-1500	Thrace, W., S. and E. (S. end) Anatolia	-	3	-	-				X	L
	<i>Leontodon tuberosus</i>		Forests, dunes, fallow fields	0-1200	Outer Anatolia	Mediterranean	2	-	-				X	L
SALICACEAE	<i>Salix alba</i>	White willow	Lake edges, creeks and stream edges	0-2000	Turkey	Europe-Siberia	2	LC	-				X	L, O
FAGACEAE	<i>Quercus aucheri</i>	Aegean Oak	Maquis limestone slopes	0-450	SW. Anatolia	Mediterranean	3	-	-				X	L, O
GERANIACEAE	<i>Geranium purpureum</i>		Rocky or shaded places, graveled places, coasts, fields	0-2200	N., W., S. Anatolia	-	2	-	-				X	L
	<i>Erodium ciconium</i>	Stork's bill	Fields, meadows, steppes	0-1500	W., N., C., E., and 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

Tribe	Species name in Latin	English name	HABITAT	Altitude (m)	Distribution in Turkey	Phytogeographical region	Abundance	IUCN	BERN	ENDEMISM				Source:
										L	R	C	N	
			places, cultivated lands											
	<i>Lolium rigidum var. rigidum</i>		Rocks, steppes, pastures, fallow lands, vineyards, sands, roadsides	0-1850	Outer Anatolia and E. Anatolia	-	2	-	-				X	L
GUTTIFERAE	<i>Hypericum empetrifolium</i>	Yellow ling	Oak and juniper maquis, brutia pine groves and limestone rocks	0-800	W. and S. Anatolia	Mediterranean	2	-	-				X	L
	<i>Lamium moschatum var. moschatum</i>		Rocks, fallow fields, roadsides	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
LABIATAE	<i>Salvia virgata</i>	Wand sage	Bushwoods, meadows, fallow fields, roadsides	0-2300	Turkey	Iran-Turan	3	-	-				X	L
	<i>Mentha suaveolens</i>	Apple mint	Wet places, frequently drying in	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 and 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
	<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 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	Turkey and W. Anatolia	Mediterranean	4	-	-				X	L
LEGUMINOSAE	<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

Tribe	Species name in Latin	English name	HABITAT	Altitude (m)	Distribution in Turkey	Phytogeographical region	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 fields	0-500	Thrace, W., S. and C. Anatolia	-	4	-	-				X	L, O
	<i>Papaver rhoeas</i>		Fields, empty places	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 rocks	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	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 surveys. 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 43 for amphibious species, in Table 44 for reptile species, in Table 45 for bird species, and in Table 46 for mammalian species.

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

Furthermore, the lists of the resolutions of Central Hunting Commission for hunting season 2016-2017 promulgated in the Official Gazette by the General Directorate for Nature Conservation and National Parks of Turkish Ministry of Environment and Forestry are processed in the related tables.

➤ *Amphibians*

2 of the 4 amphibian species found on the project site route and its vicinity and those possible to be found due to habitat characteristics are included in the Bern Annex-2 list. Whereas, 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 lists of the latest "Central Hunting Commission Resolutions for Hunting Period 2016-2017" promulgated in the Official Gazette by the General Directorate of Nature Conservation and National Parks of the Turkish Ministry of Forestry and Water Affairs.

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

➤ *Reptiles*

6 of the 11 reptile species found in the project site and its vicinity and those possible to be found due to habitat characteristics are included in the Bern Annex-3 list, and 5 species 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, and 1 species is 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 lists of the latest "Central Hunting Commission Resolutions for Hunting Period 2016-2017" promulgated in the Official Gazette by the General Directorate of Nature Conservation and National Parks of the Turkish Ministry of Forestry and Water Affairs.

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

➤ *Birds*

20 of the 37 bird species found in the project site route and its vicinity and those possible to be found due to habitat characteristics are included in the Bern Annex-2 list, and 11 species 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, and 1 species is in NT (Near threatened) category.

According to the lists of the latest "Central Hunting Commission Resolutions for Hunting Period 2016-2017 " lists promulgated in the Official Gazette by the General Directorate of Nature Conservation and National Parks of the Turkish Ministry of Forestry and Water Affairs, 6 bird species are included in the Annex-I, which is list of "Those Under Protection by the Ministry of Forestry and Water Affairs"; and 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 today.

➤ *Mammals*

1 of the 8 mammal species found on the project site route and its vicinity and 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 list of the "Central Hunting Commission Resolutions for the Hunting Period 2016-2017" lists promulgated in the Official Gazette by the General Directorate of Nature Conservation and National Parks of Turkish Ministry of Forestry and Water Affairs, 1 mammal species is included in Annex-I; and 2 mammal species are included in 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 located within a Wildlife Development and Breeding Site or a National Park or Nature Reserve Area or Natural Park or a Forbidden Area For Hunting determined by the General Directorate of Nature Conservation and National Parks of Turkish Ministry of Environment and Forestry.

Table 43. Amphibian species with high probability of existing within the project site and its sphere of influence, protection statuses of these species

TRIBE	NAME IN LATIN	NAME IN ENGLISH	HABITAT	ENDEMISM	IUCN	RDB	BERN	SOURCE
PELOBATIDAE	<i>Pelobates syriacus</i>	Eastern Spadefoot	Under rocks and in soil	-	LC	nt	Annex-III	L
HYLIDAE	<i>Hyla arborea arborea</i>	European Tree Frog	On trees and bushes	-	LC	nt	Annex-II	L
BUFONIDAE	<i>Bufo bufo</i>	Toad	Under rocks and in soil	-	LC	nt	Annex-III	L
	<i>Bufo viridis</i>	European green toad	Under rocks and in 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 44. Reptilian species with high probability of existing within the project site and its sphere of influence, protection statuses of these species

TRIBE	NAME IN LATIN	NAME IN ENGLISH	HABITAT	ENDEMISM	RDB	IUCN	BERN	Population	CHC	SOURCE
TESTUDINIDAE	<i>Testudo graeca</i>	Tortoise	Sandy, stony dry lands	-	nt	VU	Annex-II	2	-	L
GEKKONIDAE	<i>Hemidactylus turcicus</i>	terrestrial house gecko	Id ruins, rock crevices, under 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 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	Fields and stony fields, fields and gardens	-	nt	NT	Annex-II	2	-	L
	<i>Coluber caspius</i>	Caspian Whipsnake	Fields, swamps 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, Omurgalılar "Sürüngenler, Kuşlar ve Memeliler" [Vertebrates "Reptiles, Birds and Mammals"] Meteksan A.Ş., Ankara

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

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

-O: Observation L: Literature

Table 45. Bird species with high probability of existing within the project site and its sphere of influence, protection statuses of these species

TRIBE	NAME IN LATIN	NAME IN TURKISH	NAME IN ENGLISH	HABITAT	STATUS	RDB	IUCN	BERN	CHC	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	Fields, open fields, woodlands and mountainous	Y	A.4	LC	Annex-III	Annex-I	L
	<i>Melanocorypha leucoptera</i>	Akkanat Tarlakuşu	White-winged Lark	Residential areas and fields	G	A.1.2	LC	Annex-II	-	L
HIRUNDINIDAE	<i>Hirundo rustica</i>	Kır kırlangıcı	Barn Swallow	Human residential areas	G	A.5	LC	Annex-II	-	L
	<i>Delichon urbicum</i>	Pencere kırlangıcı	Northern House Martin	Residential areas 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 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, parks and cemeteries	G	A.2	LC	Annex-II	-	L
	<i>Turdus pilaris</i>	Ardıç	Fieldfare	Woodlands 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	Residential 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	Residential areas and forests	Y	A.2	LC	Annex-II	-	L
	<i>Falco peregrinus</i>	Gezginci Doğan	Peregrine Falcon	Forests and open areas	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 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>	Kızılısrıtlı 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 sporadice trees and shrubs, orchards, sparse 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	Residential areas and fields	Y	A.5	LC	-	Annex-I	L
PASSERIDAE	<i>Passer domesticus</i>	Ev serçesi	House Sparrow	Human residential areas	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/>.

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

STATUS

Y : Annual Bird
G/KG : Migratory 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 Turkey prepared by Prof. Dr. İlhami Kiziroğlu:

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 : Geçici olarak Türkiye'ye gelen ve biyotopların yok edilmesi ile risk altına girecek türler
B1 : Species that settle in Anatolia in winters but do not breed in Anatolias
B2-B3 : Species that pass Anatolia transit or settle in Anatolia in winter and have lower risk.

Table 46. Mammalian species with high probability of existing within the project site and its sphere of influence, protection statuses of these species

TRIBE	SCIENTIFIC NAME	NAME IN ENGLISH	HABITAT	RDB	IUCN	BERN	CHC	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	, vineyards, gardens, ruins, residential areas	nt	LC	-	Annex-I	L
CRICETIDAE	<i>Cricetulus migratorius</i>	Grey dwarf hamster	Meadows, fields and steppes	nt	LC	-	-	L
LEPORIDAE	<i>Lepus europaeus</i>	European hare	All kinds of habitats	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/>

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

-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:

-Deliberate damage to or destruction of breeding or resting sites;

-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;

-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 recognizable 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 site 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 Aydın province¹⁸. These areas are the following:

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

-Dilek Peninsula (Söke, Kuşadası): National park, natural protected area. The air distance to the project site is approximately 39 km.



Figure 77. Dilek Peninsula

-Büyük Menderes Delta (Söke, Didim): National park, natural protected area. The air distance to the project site is approximately 46 km.



Figure 78. Büyük Menderes Delta

-Lake Bafa (Söke, Didim, Milas): Natural park. The air distance to the project site is approximately 37 km.



Figure 79. Lake Bafa

--West Menteşe Mountains (Söke, Koçarlı, Çine, Karpuzlu, Yenihisar, Yatağan, Milas): Archaeological site, natural protected area. The air distance to the project site is approximately 10 km.



Figure 80. 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 site is approximately 63 km.



Figure 81. Akdağ-Denizli

Important Bird Areas in Turkey:

The project will be carried out within the boundaries of Aydın Province. 3 of the "Important Bird Areas in Turkey" are located in Aydın province¹⁹. These areas are the following:

-Dilek Peninsula (Söke, Kuşadası): National park, natural protected area. The air distance to the project site is approximately 39 km.

-Büyük Menderes Delta (Söke, Didim): National park, natural protected area. The air distance to the project site is approximately 46 km.

-Lake Bafa (Söke, Didim, Milas): Natural park. The air distance to the project site 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.1.13. Whether or not there are mines and fossil fuel sources in or near the project site (if any, reserve amounts, current and planned operating conditions, annual production and their significance for the country or local uses and their economic values)

Mines and energy resources in Aydın Province²⁰

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 widespread as well.

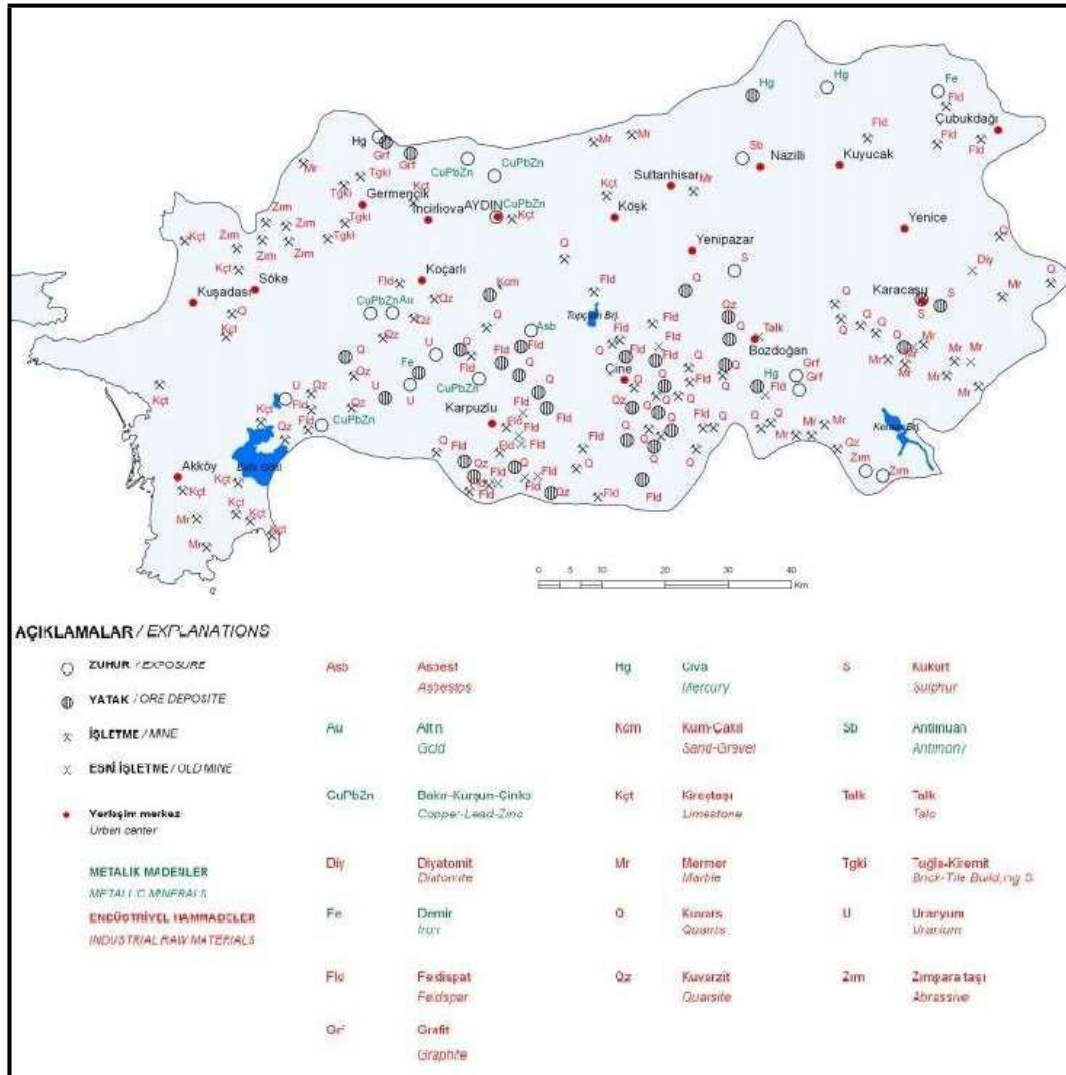


Figure 82. Mining map of Aydın Province

As for metallic minerals, there are formations of gold, copper, lead, zinc, mercury and iron. In Koçarlı- Satılar gold mine; 1 g/ton-grade 5.630 ton visible+ potential reserve is present. Copper, lead, zinc mineralization is found in Aydın city centre and districts Söke, Çine, and Koçarlı, but not economical because of having low-grade small-size appearances. In Bozdoğan- Altıntaş site; there is a deposit with %2 cinnabar-graded 52.500 ton reserve, but it is not in operation.

²⁰ Source: Mineral Research and Exploration <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, Fe values up to %54.46 are also determined in the deposit. Average silica content of the deposit is 28%. Accordingly, 119,000 ton high-grade and 360,000 ton low-grade and high silica ores are observed in the deposit. In Söke-Çavdar iron site, there is an averagely 42.62% Fe and 22.05% Si-grade 13,500,000 tons of visible and possible reserves are present. This ore deposit cannot be operated currently due to the high silica, low-grade and partially high sulfur values.

Besides the metallic ore deposits; there are rich deposits in terms of industrial raw materials. In addition to industrial raw materials such as barite, diatomite, graphite and quartz, mines produced from the feldspar deposits, 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 deposit 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, which 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 deposit having 4-5% S-grade, 51,800 ton visible and potential sulfur reserve cannot be operated currently due to its low-grade.

As for marble, Karacasu district has a significant potential. In the district; totally 30 million m³ potential marble reserve is determined in the sites Geyre, Tepecik, Hangediği, and Nargedik. These sites are operated by the private sector. As for mica, Germencik-Dağyeri site has a good quality, but its reserve has not been determined, yet; so 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 potential uranium reserves have been identified.

In Çavdar-Demirtepe site, 0.0234%-grade 263,343 tons of U₃O₈ with 0.0234%-0.0956 (autinite, bassettite, uranopilite) quality and 0.0956%-grade 1,456,687 tons of U₃O₈, that is totally 1,728,207 tons of visible and potential uranium reserves is present. In Kisir-Osmankuyu site, 0.02-0.03% U₃O₈ uraninite, gummite, uranotile, torbernite, autinite, meta-autinite, meta-torbernite, phosphoranilite minerals have been identified, and totally 45,895 tons of potential 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 deposits as corundum, magnetite and sandpaper are present; and 172,000 tons of visible+ potential reserves in Karacasu and 55,000 tons of potential reserves in Söke have been identified. There are sandpaper deposits under operation.

Turkey is in the first rank in albite production in the world. Almost all the production is in Çine - Milas. There are facilities for feldspar enrichment in this region. About 1.5 million tons/year of albite is exported from Çine-Milas region.

In Aydın city centre, Söke district and Çine-Karpuzlu-Akçaova deposits; 8-11.44% K₂O and 0.73% Fe₂O₃ containing 1,878,516 tons of potential and medium-low quality 151,819 tons of potential 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 potential and 21,987,172 tons of medium-low quality albite (sodium feldspar) reserves are present. These deposits are now under operation for domestic and foreign markets in order to be used in ceramic and glass industry.

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

The project site 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 no. 3213, the Mining Activities Application Regulation, and the Law no 5686 on Geothermal Resources and Natural Mineral Waters shall be observed.

II.1.14. Livestock and aquaculture (species, feeding areas, annual production amounts, their significance for the national economy and their economic values, fishery within the sphere of influence, fishing grounds)

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, whereas poultry is also important in some regions.

Bovine breeding data for Aydın Province and Germencik District are given in the following table.

Table 47. 2015 bovine breeding data of Aydın Province

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

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

Table 48. 2015 bovine breeding data of Germencik district

Name of animal	Adult	Young-baby	Total	Number of milked animals	Milk (Ton)
Cattle (cultivated)	9,762	4,388	14,15	5,052	20,031.180
Cattle	1,347	603	1,95	705	1,910.008
Cattle (native)	137	63	200	70	98.349

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

Ovine breeding data for Aydın Province and Germencik District are given in the following table.

Table 49. 2015 ovine breeding data of Aydın Province

Name of animal	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: TÜİK, www.tuik.gov.tr, January, 2017.

Table 50. 2015 ovine breeding data of Germencik district

Name of animal	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: TÜİK, www.tuik.gov.tr, January, 2017.

Poultry data for Aydın Province and Germencik District are given in the following table.

Table 51. 2015 poultry farming data of Aydın Province

Name of animal	Current number
Broiler	2,776,180
Laying hen	631,682
Turkey	6,478
Goose	2,717
Duck	3,238

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

Table 52. 2015 poultry farming data of Germencik District

Name of district	Name of animal	Current number
Germencik	Broiler	600

Source: TÜİK, 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, small actors in the sector were withdrawn and this field of activity has become controlled mostly by large companies. The following figure shows the amount of aquaculture products produced in Aydın province.

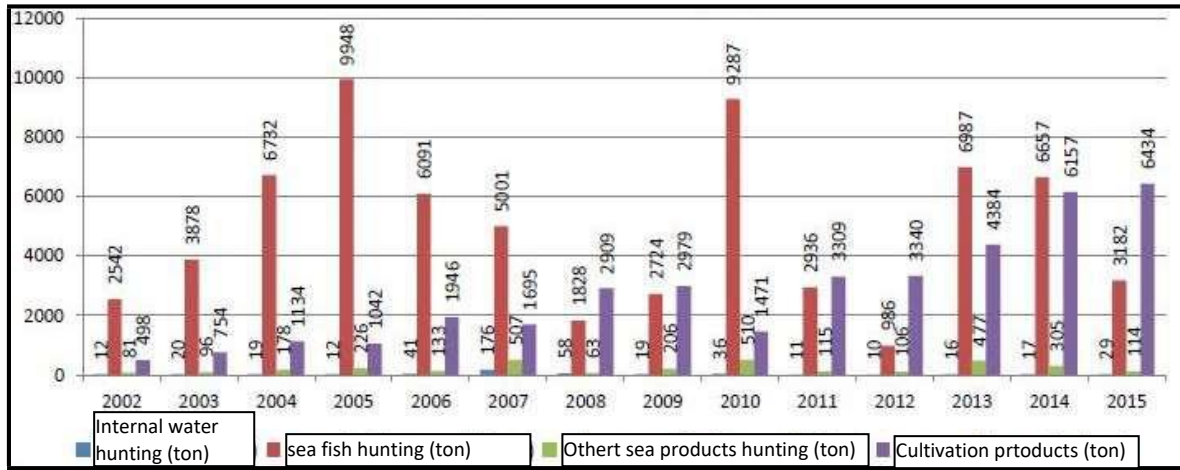


Figure 83. Quantities of fisheries in Aydın Province by years

Source: Environment status report 2015 for Aydın Province

II.1.15. Places with high landscape value and recreation areas

There are no areas of high landscape value in the project site 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.1.16. Lands under the authority and possession of the competent bodies of the government (prohibited military zone, areas allocated to public institutions and organizations for specific purposes, etc.)

In the project site, 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.1.17. Current pollution load of the project site and the sphere of influence (determination of the current pollution load in terms of air, water, soil and noise, what kind of studies were carried out between which dates when doing this work, work methods, indication of meteorological conditions during the work period)

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

Table 53. Regular measurements for determining the current situation

Item	Parameter	Period	Location
1	H ₂ S	Continuous	

Measurements and analysis of samples taken at certain points within the J-553 licensed field were carried out by accredited authorized laboratories. The results of H₂S measurements ²¹ carried out at 3-month intervals at certain points of the licensed field in 2015 and after are given in Annex-18.

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

II.1.18. Other issues

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

II.3. Characteristics of social-economic environment

II.3.1. Economic characteristics (the main sectors that constitute the economic structure of the region, distribution of local workforce to these sectors, role and significance of the production of goods and services by the sectors for the national economy, other information); Income (distribution of income in the region to lines of business, maximum, minimum and average income per capita by lines of business); unemployment (unemployed population in the region and ratio to active population)

Economic Structure²²

Aydın is generally known as an agriculture 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 agricultural sector. The importance of Aydın for national agriculture is revealed by taking place in the top 10 list of Turkey for 25 crops produced. Aydın province is number one in fig and chestnut production and number two in olive, cotton, artichoke and strawberry, and 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 23 archaeological site and 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 centers of Turkey, 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 environmental laboratory 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. 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 national 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.

Workforce Data of Aydın Province²³

When the distribution of the companies in Aydın province by sectors is examined, it is seen that most of the workplaces are involved in construction sector. Approximately one of every 4 workplaces 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 workplaces covered by the survey in Aydın. 69.8 percent of the employees are male, whereas 30.2 percent are female. As for the distribution of employees in the province of Aydın by vocational groups, most of the employees are included in the Craftsmen vocational group. 23.5 percent of the employees are in this vocational group. In the survey, it was determined that 8 percent of males and 6.5 percent of females work in jobs not requiring any qualifications.

In Aydın province, 6 percent of the workplaces have part-time employees. There are workplaces in 16 sectors within the scope of the survey in Aydın, while 9 sectors have part-time employees. Accommodation and Food Services sector has the highest number of part-time employees. 18.8 percent of the workplaces included in the scope of the survey 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 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 vacancies were determined in 201 different occupations, this figure was 771 in 246 different occupations in the previous year. From this point of view, a small decrease was observed in the number of job vacancies and occupational diversity in 2015 compared to the previous year.

17.3 percent of the workplaces in Aydın province stated that they have job vacancies. The total number of job vacancies in 292 workplace in Aydın was 1650, whereas the job vacancy ratio was 3.8 percent. The highest ratio of job vacancies of Aydın province is 29.2 percent in the Accommodation and Food Services sector Manufacturing sector is the second with 21.4 percent and Transportation and Storage sector is the third with 17.8 percent.

²³ SKUR, 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.

As for the distribution of the job vacancies in the province of Aydın by vocational groups, most of the job vacancies is in the Craftsmen vocational group. 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 Manufacturing Worker, Waiter (Service Person) and Service Bellboy, respectively. 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.

As for the education levels demanded by the sectors, 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 İŞKUR 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 Staff, 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.

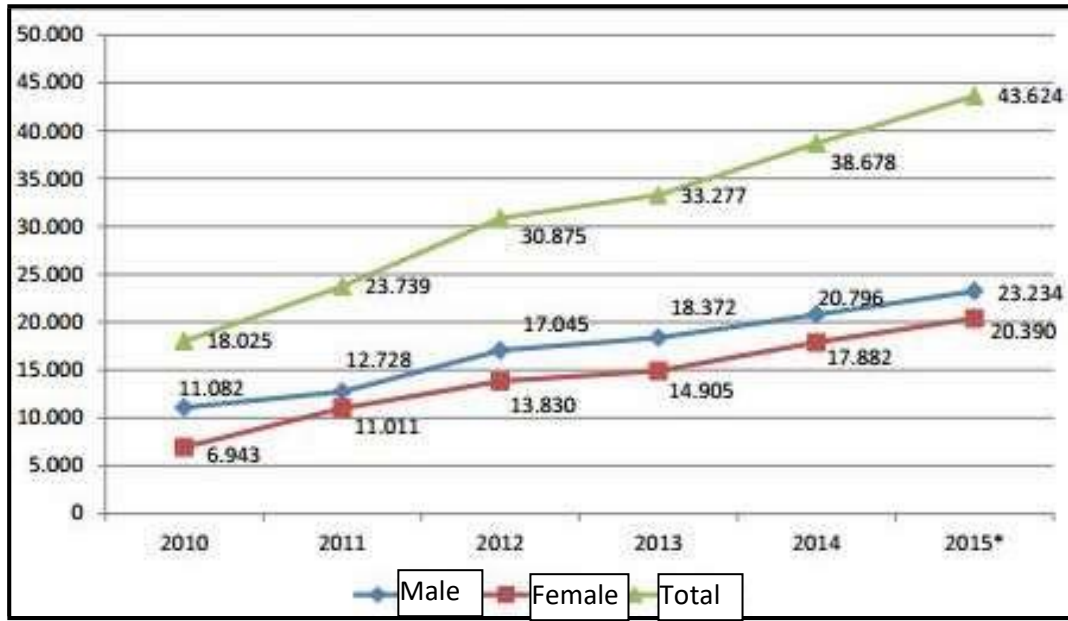


Figure 84. Distribution of registered unemployed by gender in Aydın Province

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

As for the occupations in the registered unemployed, job vacancy and job placement indicators, the occupations demanded by the labor 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 workplaces covered by the survey in Aydın. 69.8 percent of the employees are male, whereas 30.2 percent are female. 72.5 percent of the employees in the workplaces employing 10 and more people is men, whereas 27.5 percent is women across Turkey. The share of women in total employees is low in Aydın. According to the results of 2014 Regional Household Labor 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 across Turkey (18.5 percent). The number of women working in the healthcare and education sectors is greater than the number of men working in both Turkey and Aydın. The rate of women working in workplaces covered by the survey in Aydın (30.2 percent) is close to the rate across Turkey (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.

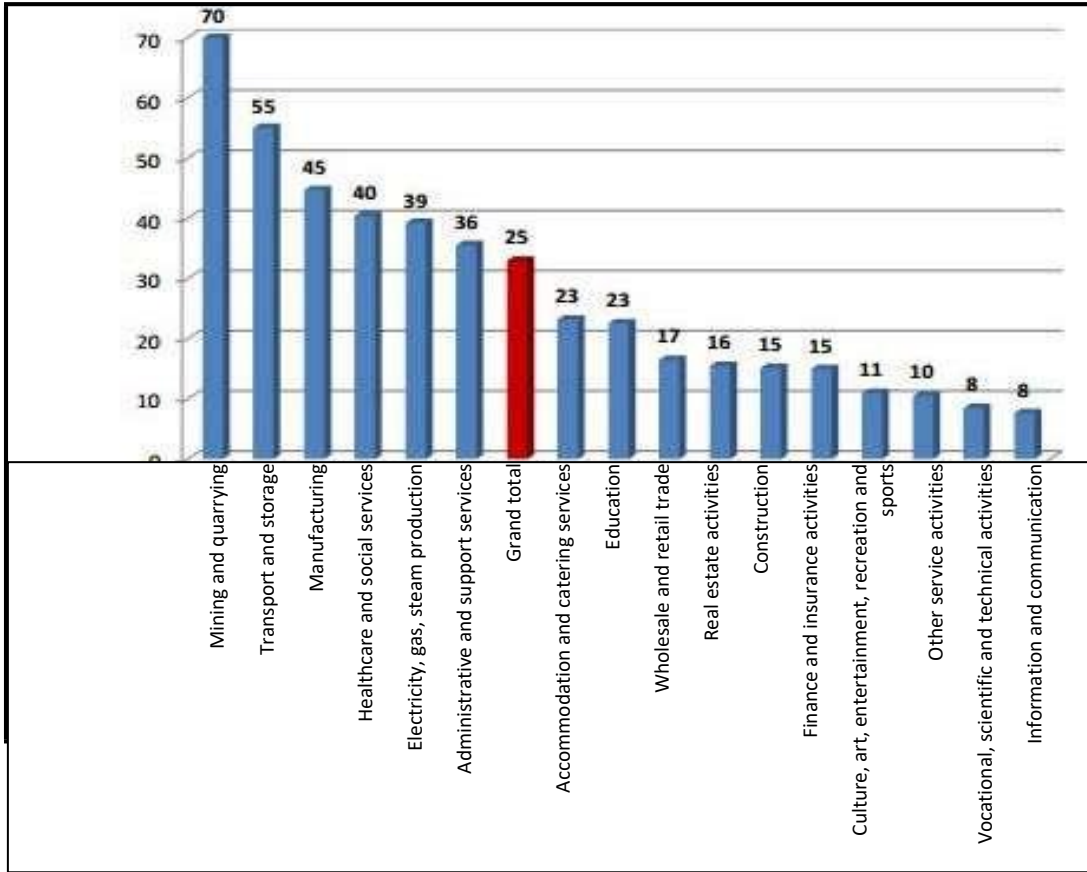


Figure 85. Average number of employees by sectors in Aydın Province

It is observed that problems such as the lack of intermediate level workforce needed by the manufacturing sector in particular, the fact that women are not represented in workforce 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 workforce 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 should be aimed for the purpose of contributing to the acceleration of economic development in the Aydın province. Trainings must be really qualified, teach the skills required by workplaces, 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 vocational training specialists.

In addition, women are expected to be locomotives in the workforce 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 workforce, awareness-raising activities on this issue throughout the province and non-governmental organizations to operate in this regard.

It is apparent that a corporate and professional approach is needed in the tourism sector, which is the most important economic income source of Aydın province. The fact that the tourism sector dominates the job vacancies and occupations requires 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 the 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 (ABPRS) database of 2015.

Table 54. Population of Aydın Province

Year	Male population	Female 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: TÜİK, www.tuik.gov.tr, January, 2017.

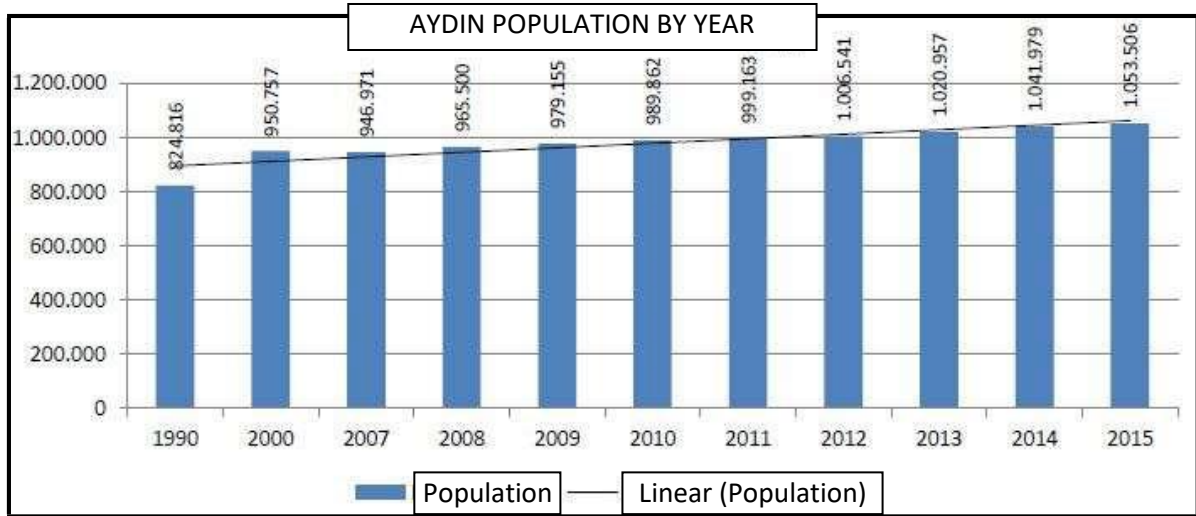


Figure 86. Graphic of population growth in Aydın Province by years

The population information of districts of Aydın are given in Table.55.

Table 55. Population of Aydın's districts

District	Population in 2015	Male	Female
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	5,690	5,752

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

The population of Germencik is 43,367 according to the Address Based Population Registration System (ABPRS) database of 2015.

Table 56. Population of Germencik District

Year	Male population	Female population	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: TÜİK, www.tuik.gov.tr, January, 2017.

Population movements, migration²⁴

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

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

²⁴ Environment status report 2011 for Aydın Province

Short-distance temporary migration, which have remained important after the 1960s as well as the long-distance permanent family migration eliminated this negative effect, and the share 15-64 age group increased again, whereas the increase in workforce has been equalized to overall 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 46,477 people emigrated 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. 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 agricultural labor 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. The university opened has greatly contributed to the population increase in the recent years in the Province. This has also changed the quality of the immigrant 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 labor. As a matter of fact, 45% of those who migrated to the province in 1975 were seasonal agricultural workers originating from surrounding provinces such as Muğla, Denizli, Burdur, Afyon, and 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.

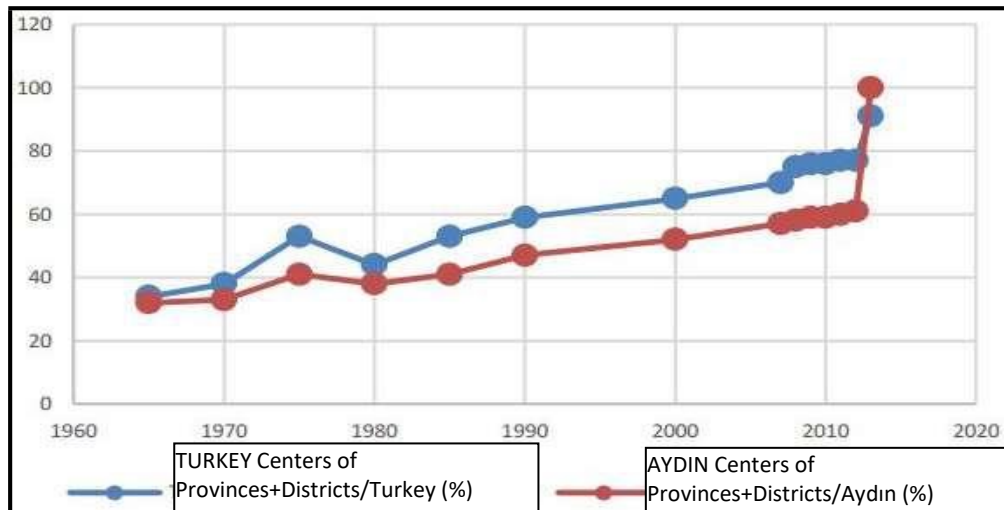


Figure 87. Change in urban population percentages of Aydın and Turkey

Source: Environment status report 2014 for Aydın Province

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.

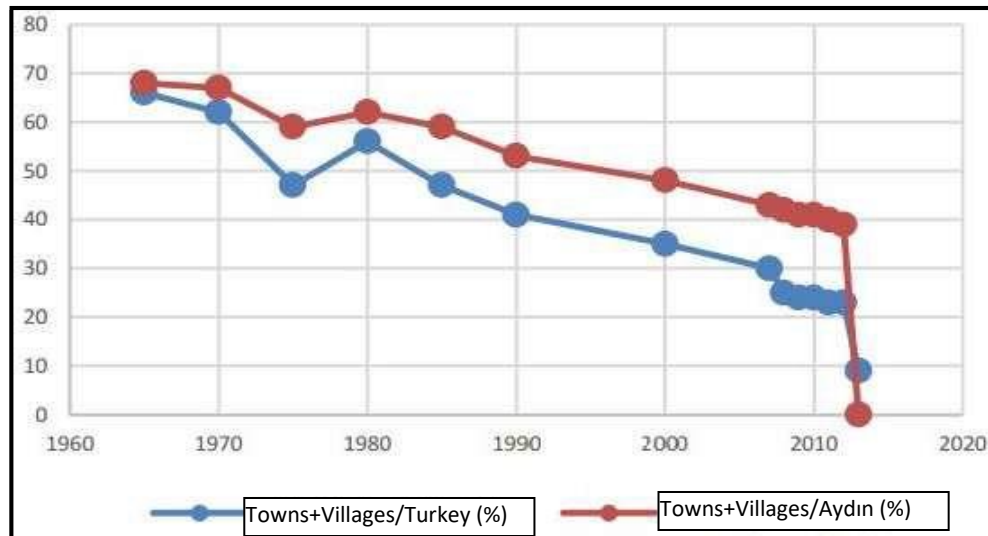


Figure 88. Change in rural population percentages of Aydın and Turkey

Source: Environment status report 2014 for Aydın Province

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

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 residential areas, current and planned use areas, industrial zones, residences, touristic areas in this context, etc.); Social infrastructure services in the region (education, health and cultural services and the availability of these services)

Urban and rural land uses²⁵

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

Table 57. Land utilization in Aydın province

Use area	Surface 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]

²⁵ Environment status report 2011 for Aydın Province

There are 17 district centers whose urban settlements are within the province in Aydın. Among these centers, the City Centre is the most densely urbanized settlement. According to TÜİK 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, İncirliova, 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 58.

Table 58. Numbers of schools, classrooms, teachers, and students in Aydın Province in academic year 2016-2017

SCHOOL TYPE	# of schools	# of classrooms	Branches	Total # of teachers			Total # of students		
				Total	Male	Female	Total	Boys	Girls
Public kindergartens	41	194	278	297	19	278	5,298	2,569	2,729
Private kindergartens	19	112	82	87	11	76	953	424	529
Kindergartens total	60	306	360	384	30	354	6,251	2,993	3,258
Nursery classes within public primary schools	250	306	400	391	12	379	7,049	3,674	3,375
Nursery classes within public secondary schools	39	45	62	66	2	64	1,040	548	492
Application nursery classes within high schools	7	14	15	45	1	44	222	104	118
Nursery classes within public high schools	1	3	2	0			23	14	9
Nursery classes within private primary schools	15	38	37	42		42	488	252	236
Total of nursery classes within upper schools	312	406	516	544	15	529	8,822	4,592	4,230
Preschool 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 combined classes	96	323	374	183	92	91	2,142	1,125	1,017
Independent primary schools	225	2,661	2,491	3,182	1,328	1,854	47,562	24,338	23,224
Private primary schools	20	267	158	274	70	204	2,728	1,456	1,272
Grand total of primary schools	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 schools	1	12	8	19	14	5	157	96	61
Secondary schools for imams-preachers	25	252	182	254	123	131	3,677	2,024	1,653
Boys' secondary schools for imams-preachers within high schools for	1	0		0			0		
Girls's secondary schools for imams-preachers within girls' high schools for imams-preachers	2	10	9	0			166		166
Grand total of schools for imams-preachers	28	262	191	254	123	131	3,843	2,024	1,819
Private secondary schools	25	256	250	444	152	292	4,360	2,314	2,046
Grand total of secondary schools	236	2,868	2,582	4,350	1,932	2,418	58,594	30,130	28,464
Grand total of primary and secondary schools	577	6,119	5,605	7,989	3,422	4,567	111,026	57,049	53,977
Common high schools	46	965	1,124	1,694	862	832	21,907	9,618	12,289
Private high schools	33	411	343	602	285	317	4,533	2,363	2,170
Total of common high schools	79	1,376	1,467	2,296	1,147	1,149	26,440	11,981	14,459
Mixed Anatolian high schools for imams-preachers	13	215	105	180	88	92	1,666	1,156	510
Boys' Anatolian high schools for imams-preachers	1	29	58	32	26	6		335	
Girls' Anatolian high schools for imams-preachers	2	35	54	31	11	20	727		727
High schools for imams-preachers	16	279	217	243	125	118	2,728	1,491	1,237
Vocational and technical Anatolian high schools	42	810	1,483	1,826	1,008	818	18,117	10,295	7,822

Private vocational and technical Anatolian high schools	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
Grand total of secondary education	140	2,528	3,189	4,439	2,295	2,144	48,324	24,171	24,153
Counseling and research centers	3			44	30	14	0		
Science and art centers	1	11		11	5	6	250	126	124
Primary schools for hearing impaired (public)	1	4	4	4	1	3	8	7	1
Secondary schools for hearing impaired (public)	1	4	4	11	9	2	24	17	7
Primary schools (mild mental retardation)	2			0			0		
Secondary schools (mild mental retardation)	2	5	7	13	8	5	39	28	11
Practice centers for 1 st -level special education	4	18	24	17	7	10	110	65	45
Practice centers for 2 nd -level special education	4	17	28	33	20	13	102	67	35
Vocational training centers for 3 rd -level special education	3	34	49	59	30	29	286	177	109
Job practice centers for 3 rd -level special education	3	14	20	37	12	25	123	73	50
Grand total of special education	24	107	136	229	122	107	692	434	258
Grand total of formal education	801	9,466	9,806	13,585	5,884	7,701	175,115	89,239	85,876
Public education centers	17	93		186	74	112	261,080	136,527	124,553
Vocational education centers	10	60		153	125	28	5,728	5,124	604
Grand total of life-long learning	27	153		339	199	140	261,080		
Teacherages	7			14	14		0		
TOTAL OF INSTITUTIONS & SCHOOLS	835	9,619	9,806	13,938	6,097	7,841			
Special education and rehabilitation centers (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 courses	25	203		108	56	52	1,403	654	749
Specific Student Study & Education Centers	31	172		107	26	81	1,164	602	562
Various private courses	27	118		95	65	30	2,286	866	1,420
Private dormitories	86			0					
Total of private non-formal education	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 marine border gate has brought Aydın city as one of the most developed cities of the sector in terms of tourism. Because the west side of Aydın opens to Aegean sea, Kuşadası and Didim districts are suitable for every area of tourism and other districts are more suitable for folkloric and archaeological values as daily visits. Thus, investments are accumulated in these two coastal districts, and forward looking requests intensify on this area. Another key feature of Aydın is being very close to İzmir metropolitan area and being directly within its sphere of influence. 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. Maritime transport is provided from the Kuşadası port within the city, whereas İzmir port is used for larger-scale transportation.

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

The Söke extension, which is the first railway line of Turkey, passes through the province along with the Aydın-İzmir line. Menderes airport is on the Aydın-İzmir highway, so it serves Kuşadası and Didim in addition to Aydın and İzmir. Aydın's climate, which is suitable and enables a longer tourism season, is one of 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. 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, Aydın, Nazilli and Denizli. There is a significant difference between the west and east sides of Aydın in terms of tourism. The west side is an area where the resources providing service to domestic and foreign tourism are put into use and required interventions are being done in order to put the potential resources into use. The 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 was a part of Hittite, Ionia, Lydia, Rome, Byzantine, Anatolian Seljuks, Aydioğulları, Menteşoğulları and the Ottoman Empire since the end of the 4,000 BC has a great potential in terms of domestic and especially foreign tourism with its ancient cities and museums. Particularly Miletus, Didyma, and Alinda at the west, Alinda and Alabanda at the central south, Tralleis, Nyssa at the north, Aphrodisias at the east and İzmir, Ephesus and the House of the Virgin Mary at the east, Hierapolis in Denizli at the east, the ancient cities of Labranda, Lasos and Halikarnassos in Muğla at 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 attractions of 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 Olukbaşı 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, İncirliova, Kuyucak and Köşk railway station buildings are examples of the 19th century economy and transportation history.

Health tourism (thermal)

There are various thermal facilities of all sizes in Aydın. There are 6 thermal facilities in the region which are Alangüllü (Bozköy), Ömerli and Gümüş (Gümüşlîca) in Germencik; Davutlar in Kuşadası, Salavatlı and Buharkent in Sultanhisar. Alangüllü spring: It is in Bozköy of Germencik district. There is a facility with 32 rooms and 70 beds and an indoor thermal pool licensed 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 largest thermal springs in the region. Gümüşköy spring: It is in Gümüşköy of Germencik District. 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 Davutlar town of Kuşadası district. Salavatlı spring: It is in the west of Sultanhisar. It is currently active.

Sports 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

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

CHAPTER III

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

CHAPTER 3: ENVIRONMENTAL IMPACTS OF THE PROJECT DURING CONSTRUCTION AND OPERATION PHASES AND MEASURES TO BE TAKEN

(In this chapter, impacts of the project on the physical and biological environment and the legal, administrative and technical measures to be taken to prevent, minimize and recover these impacts are explained separately and in detail for headings III.1 and III.2.)

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

III.1. Impacts of the project on the physical and biological environment during the preparation of the land and the construction phase, and measures to be taken

III.1.1. Where and how much excavation and vegetable soil will occur within the scope of the works for during the preparation of the land, excavation and vegetable soil amounts, materials to be used, explosives, information about the blasting, if any, its impacts and measures to be taken, where to transport excavated waste soil, stones, sand, etc. and vegetable soil, where to store the same, the volume of the area, and the purposes for which it is used, excavation material arrangement and restoration plan, opinions to be taken and characteristics of temporary storage area

Under the Efe-8 Geothermal Power Plant project, an area, the total surface area of which is 36,705.33-m², composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province will be used.

In terms of land preparation and construction, site leveling, foundation excavation and construction, rough and fine production, machinery % equipment deployment, installation of heating, ventilation and sanitary systems, and finally, landscaping will be completed.

Amount of topsoil

20 cm-thick topsoil will be stripped gradually prior to construction, and it will be stored temporarily in a place, the inclination of which does not exceed 5% pursuant to the standards stipulated in the "Regulation on Control of Excavation Soil, Construction And Demolition Waste", and will be used in landscaping works of the site. No crushing and grinding process shall take place for 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 = 36,705 m² x 0.20 m

Amount of Topsoil to Occur = 7,341 m³

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

Amount of Topsoil to Occur = 7,341 m³ x 1.6 ton/m³

Amount of Topsoil to Occur = 11,745 tons

Amount of excavation soil

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

Table 59. Approximate area covered by units and approximate amount of excavation to be occurred

Unit	Surface area (m ²)	Excavation depth (m)	Amount of excavation
Cooling tower	5,700 x 2	0.40	4,560
Generator and turbine	1,600 x 2	1.5	4,800
Administrative building	710	1	710
Total			10,070 m ³

10,070 m³ of excavation will be carried out in the project site. An Layout Plan illustrating the operating units and their positions is given in Annex-7.

Within the scope of the intended project, pool, switchyard and workshop use will be provided from Efe-1-3-4 Geothermal Power Plants operating at north of Efe-8 GPP project site, and no separate pool will be built within the scope of Efe-8 Geothermal Power Plant project.

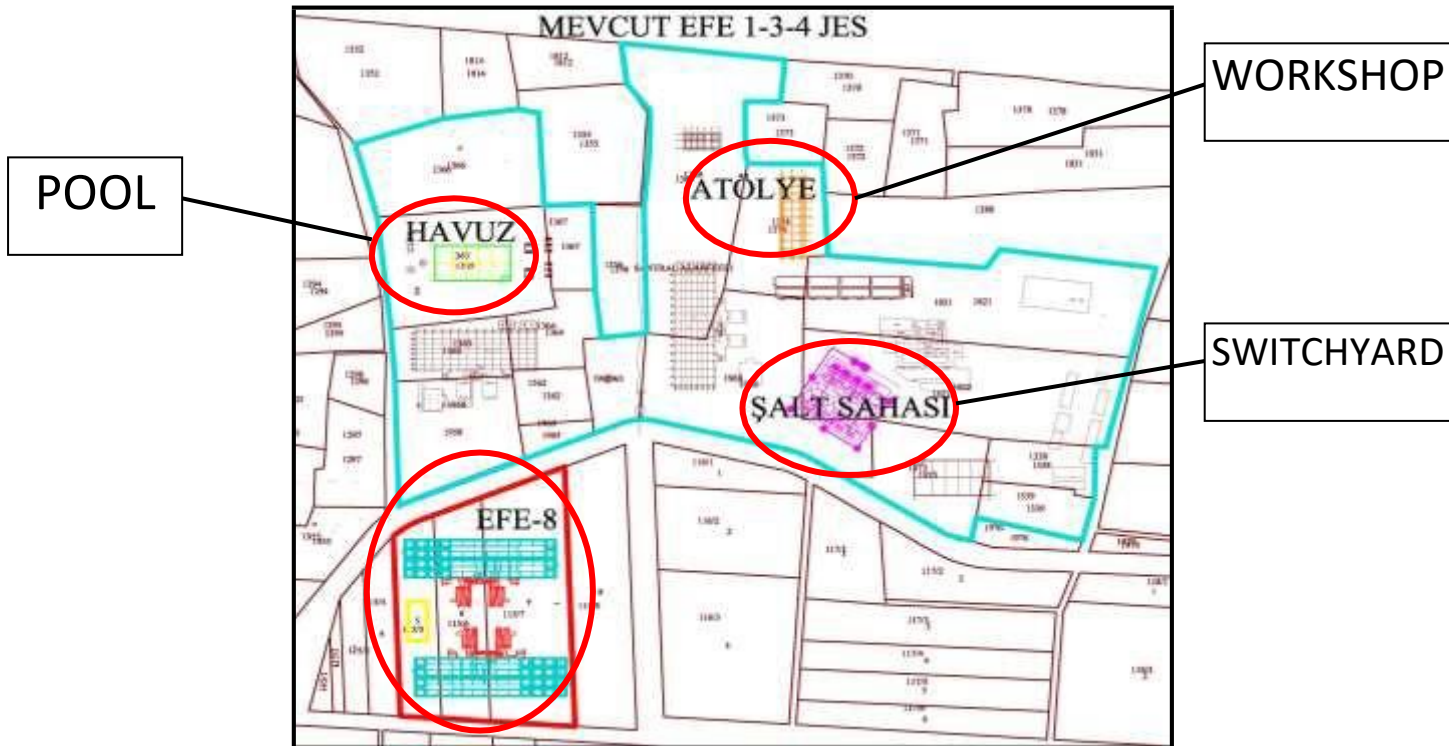


Figure 89. Intended uses

The construction of the plant is intended to be completed in 12 months working 8 hours a day and 25 days a month.

Any surplus excavation material extracted from the site will be accumulated in a suitable place within the site and then reused for landfill and land smoothing.

During the excavation works to be done under the project, the provisions of the "Regulation on Control of Excavation Soil, Construction and Demolition Wastes" promulgated in Official Gazette issue no 25406 dated 18.03.2004 shall be complied with.

III.1.2. Transportation, storage and use of flammable, explosive, hazardous, toxic and chemical substances to be used during the preparation of the land as well as for the erection of the units, instruments and machines to be used for this work; Types and properties of fuels to be used in these instruments and machines, emissions to be formed, measures to be taken

No flammable or explosive substances will be used during the construction phase of the intended project. Construction equipment will be used for the work to be done. The construction equipment to be used are given in Table 60.

Table 60. List of machinery & equipment planned to be used in the construction area

MACHINERY-EQUIPMENT	QUANTITY
Excavator	1
Loader	1
Trucks	4
Roller	1
Cement mixer truck	1
Concrete pump	1
Diesel crawler crane	1

Emission formation by construction equipments

Construction equipments such as excavators, trucks, loaders etc. will use diesel fuel during preparation of the land and stripping of the topsoil within the scope of the project. Diesel fuel will be supplied from nearby fuel stations, whereas the specifications of diesel fuel are given in the following table.

Table 61. Diesel fuel specifications

PARAMETER	UNIT	VALUE
Density (15 °C'de)	Kg/m ³	820-845
Flash point	°C	55
Cold filter plugging point - winter	°C	-15
Cold filter plugging point - summer	°C	5
Sulfur	Mg/kg	10
Carbon residue (on 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 62.

Table 62. 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 simultaneously be active, and the average speed of the vehicle will be 40 km/hr and both these values and the "RIAPC" (Regulation on Industrial Air Pollution Control) limit values in Annex-2, Table 2.1. are provided in Table 63.

Table 63. Total mass flow emitted from vehicles to be operated within the scope of the project

PARAMETER	MASS FLOW (g/hour)	MASS FLOW (kg/hour)	EMISSION LIMITS IN TABLE 2.1. OF ANNEX-2 OF RIAPC (kg/hr)
HC (hydrocarbons)	21.7	0.022	-
CO (carbonmonoxide)	86.3	0.09	50
NOx (nitrous-oxides)	65.3	0.07	4

As seen in Table 64; 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 "RIAPC", 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 the "Regulation on Exhaust Gas Emission Control and Gas and Diesel Fuel Quality" 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 packaging materials, 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" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with for any hazardous wastes occurring in any stage 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, battery replacements will also take place outside the plant. Each accumulator will be delivered to the service station from which the new accumulator is purchased.

However, in the event of any battery replacements in the plant in case of an emergency, waste accumulators shall be stored temporarily in a sealed indoor setting within the project site, and it shall be ensured that they are disposed of by being delivered to a recovery/recycling company licensed by the Ministry of Environment and Urbanization pursuant to the provisions of the "Regulation on Control of Waste Batteries and Accumulators" (Amended: O.G. - 03.03.2005/25744, O.G. - 30.03.2010/27537, O.G. - 5.11.2013-28812, O.G. - 23.12.2014- 29214) promulgated in the Official Gazette issue no 25569 dated 31.08.2004.

The provisions of the "Regulation on Waste Landfill" (Amended: O.G. 11.03.2015 – 29292) entered into effect on 01.04.2010 and promulgated in the Official Gazette issue no. 27533 dated 26.03.2010 and the "Regulation on Control of Waste Batteries and Accumulators" (and all the amendments to the regulation) promulgated in the Official Gazette issue no. 25569 dated 31.08.2004 shall be complied with during the construction phase of the intended 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 healthcare facilities located in the nearest settlements. Although the amount of wastes to be occurred in the plant in this context 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 colored plastic bags which are resistant to puncturing, tearing, exploding; made of original medium-density polyethylene, leak-free, with double bottom seam, with sufficient capacity to carry at least 10 kg and with double layer thickness of 100 micron, without bellows, with "International Biohazard" emblem and "ATTENTION! MEDICAL WASTE" phrase. Bags shall be filled maximum to $\frac{3}{4}$ level, and their openings shall be tightly tied; and in case deemed required, each bag shall put into another bag with the same specifications to ensure sealing. The contents of medical waste bags will never be compressed; medical wastes will not be removed from the bag, or unloaded or transferred to another container.

Wastes with cutting-puncturing features shall be separated from other wastes and placed in plastic or laminated cardboard boxes which are resistant to puncturing, tearing, cracking, exploding, and are water-resistant and leak free, impossible to open and touch the contents, with "International Biohazard" emblem and "ATTENTION! SHARP MEDICAL WASTE" phrase, 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 never be compressed, opened or emptied.

The provisions of the "Regulation on Control of Medical Waste" promulgated by the Official Gazette issue no 29959 dated 25.01.2017 shall be complied with throughout the entire project.

III.1.3. Transportation infrastructure plan within the scope of the project, distances of project site to highways, access roads to highways, measures to be taken to prevent damage to existing roads to be used for transportation and precautions to be taken in terms of traffic safety (opinions to be taken in this regard, permits)

Transportation to the activity area is by highway. Access to the intended project site 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 applicable laws and regulations published in context of this law and highways will be complied with during transportation.

Traffic Volume Load Map 2015 of the Transportation and Cost Studies Branch of the Strategy Development Department of the General Directorate of Highways is given below.

All transportation within the scope of the project shall be carried out through the existing roads; and if necessary, new roads may be constructed or existing roads can be improved.

All the vehicles and equipment to be used will be routinely controlled, the vehicles requiring maintenance will receive maintenance and other vehicles will be employed until maintenance procedures are completed, whereas the 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.

In the context of the intended Efe-8 Geothermal Power Plant project, parking needs will be provided within the plots of the project, whereas the opinion of the 2nd Regional Directorate of the State Highways will be obtained for the traffic load of the project across the region. In order to ensure safety in vehicle entries and exists to and from the plots or the project, an application will be submitted along with the necessary documents to the Transportation Department of Aydın Metropolitan Municipality for a Pass Permit.

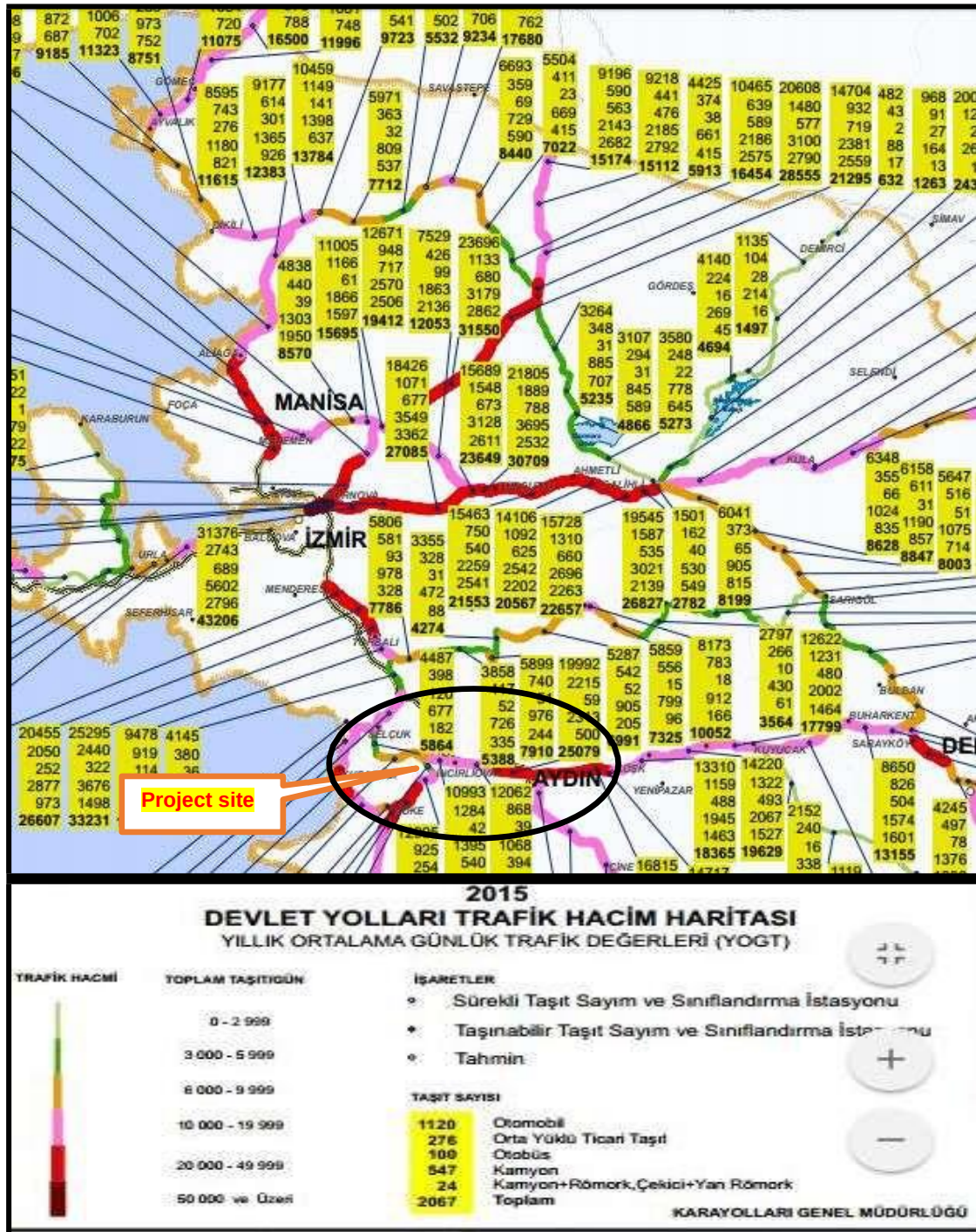


Figure 90. Traffic volume map of highways and public roads

Source: 2015 Traffic and Transportation Information

Annual Average Daily Traffic Values and Transportation Data according to Traffic Sections of Highways and State Roads, Transportation and Cost Studies Branch of the Strategy Development Department of the General Directorate of Highways, 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, neighborhood 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 neighborhood 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 neighborhood 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 the Energy Market Regulatory Authority (EMRA) within the scope of "The Law no. 5346 On Utilization Of Renewable Energy Resources For The Purpose Of Generating Electrical Energy", the "Regulation on Electricity Market Licenses", and other relevant legislations.

III.1.4. Impacts on the physical environment during the drilling regarding the use of the geothermal source, number of wells to be opened and information on how many of these are to be used for reinjection, installation of drilling equipment, the effect of actions to be taken when creating the necessary infrastructure around the wells and on the roads for to the wells to the surface morphology in this area

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.

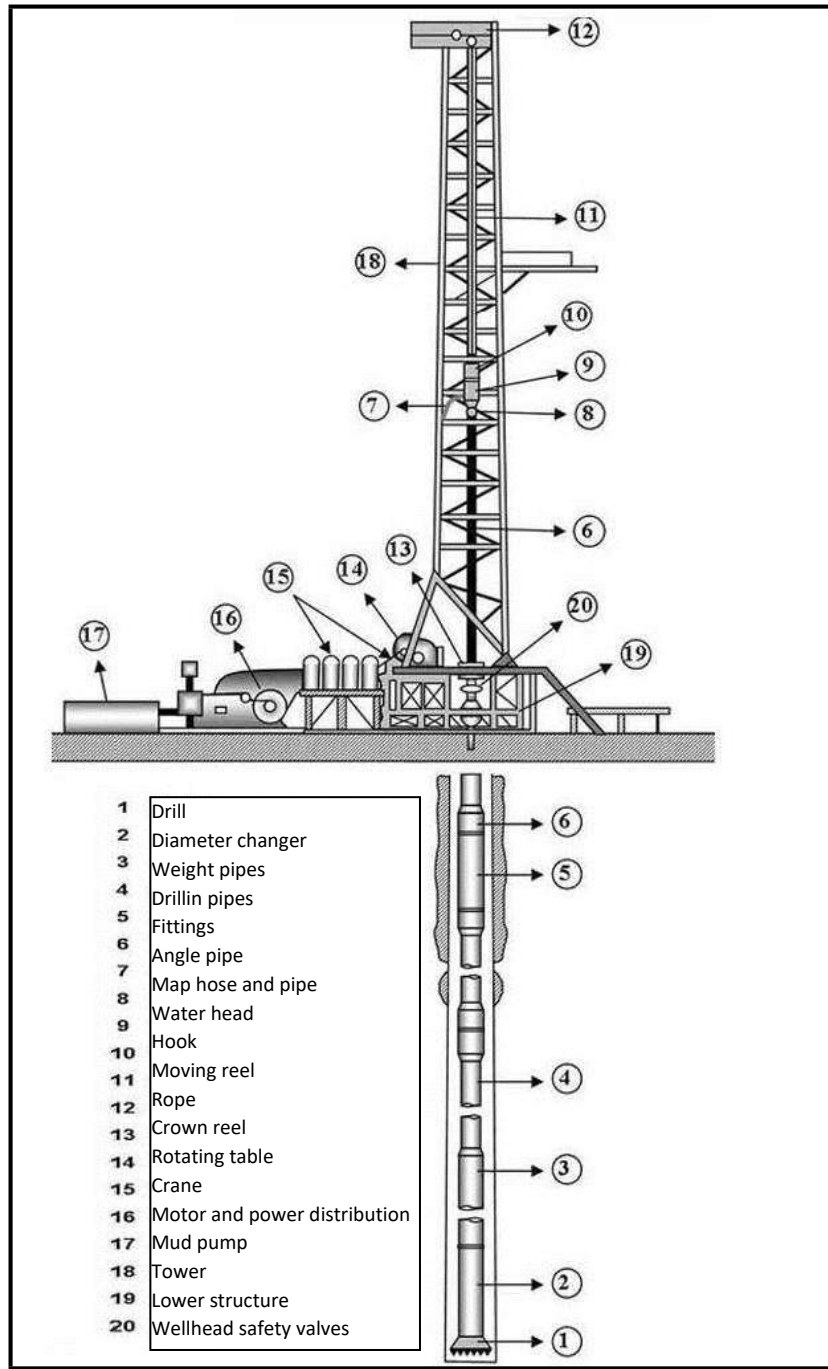


Figure 91. Typical drilling equipment

A total of 17 wells will be used for production and reinjection within the scope of the project. 9 wells will be used for production, whereas 8 wells will be used for reinjection. Only piping works will be done in the existing wells, but drilling will take place prior to piping only in the wells to be drilled from scratch.

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 92.



Figure 92. Mud pit

A small amount of excavation waste will be generated during well drilling. The excavation to be formed will be stored at a 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, if any, will be disposed of by transporting to the waste disposal sites of Germencik Municipality and/or Aydın Metropolitan Municipality.

Names and current statuses of the production and reinjection wells planned to be used within the scope of the project are given in the table below.

Table 64. Information on production and reinjection wells

	Order	Well name	Status
Production wells	1	OB-30A	Existin
	2	OB-30B	Existin
	3	OB-88	Existin
	4	OB-88A	Existin
	5	OB-88B	Existin
	6	OB-95A	Existin
	7	OB-95B	Existin
	8	OB-32	Existin
	9	OB-33	Existin
Reenjeksiyon Kuyuları	1	OB-21	Existin
	2	OB-21A	Existin
	3	OB-21B	Existin
	4	OB -21C	Existin
	5	OB -23	New
	6	OB -23A	New
	7	OB -23B	New
	8	OB -23C	New

The satellite image of the production and reinjection wells planned to be used within the scope of the project is given in Figure 93.

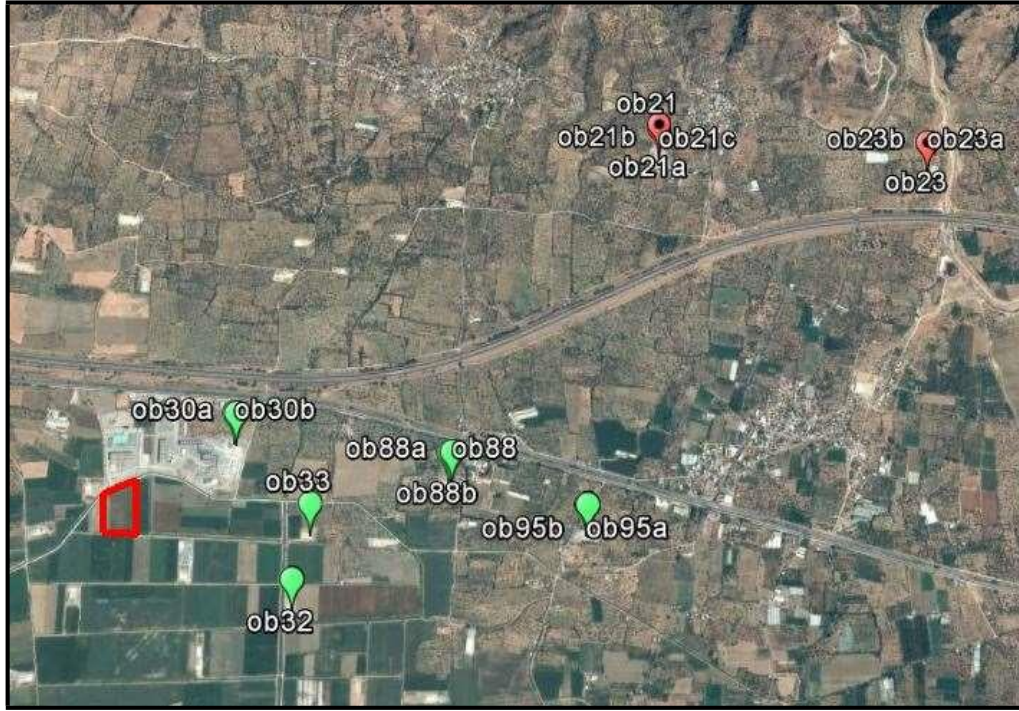


Figure 93. Satellite image of power generation and reinjection wells to be employed within the scope of the project

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 drillhole 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-22 and the representation of these wells on the map is given in Annex-21.

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. Potential impacts on groundwater during the drilling of geothermal well and construction of other units, measures to be taken to prevent groundwater and drilling fluids from mixing with each other passing through 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 their quality, necessary measures will be taken during well tests and maintenance/repairs in order to prevent natural, physical, chemical and ecological characteristics of the basin from being changed due to discharge of the test fluid.

During the works to be carried out within the scope of the project, the provisions of Law no. 167 on Groundwater, Regulation 28257 on Protection of Groundwater from Pollution and Degradation dated April 7, 2012, and Regulation on Control of Water Pollution shall be complied with.

Furthermore, during the construction and operation phase of the project, material and waste shall not be dumped into the surrounding stream 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. Amount of drilling mud, how it is to be disposed of after use, actions to be taken to clean out this mud and separate it from liquid

During the drilling operations to be carried out within the scope of the project, drilling fluid will be used. 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 mud must be increased to a value that prevents the emanation. Drilling mud to be used must have a high strength to keep the crumbs suspended, and its viscosity should be high enough to provide the capacity of bearing the crumbs while it is moving.

In accordance with the provisions of the "Regulation on Waste Landfill", the waste type will be determined by having them analyzed 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 94. 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 site 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 wellhead. 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 site is the Menderes River which is about 7 km away; the river flows in a controlled way in its bed from east to west. The streams with seasonal flow, which can cause floods during rainy times for the project site 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 measured by Aydın Weather 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 stream bed, 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 under the name 'Stream beds 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 provisions of Law on Groundwater, Regulation 28257 on Protection of Groundwater from Pollution and Degradation dated April 7, 2012, and Regulation on Control of Water Pollution shall be complied with.

Since the project site is in a 1st-degree seismic zone, all construction works within the scope of the project shall be carried by the abrogated Ministry of Public Works and Settlement in accordance with the provisions of the "Regulation on Buildings to be Constructed on Earthquake Zones" promulgated in Official Gazette issue no 26454 dated 06.03.2007 and the Regulation amending this regulation promulgated in Official Gazette issue no 26511 dated 03.05.2007.

In the implementation 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 borne will be determined and all interpretations and calculations will be made in detail.

The Geological-Geotechnical Survey Report of the Project site is presented in Annex 17.

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 site and the basis of the zoning plan shall be complied with.

III.1.9. Dust spreading operations such as crushing, grinding, washing-screening, transportation and storage during construction, cumulative values, measures to be taken

Under the Efe-8 Geothermal Power Plant project, an area, the total surface area of which is 36,705.33-m², composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province will be used.

In terms of land preparation and construction, site leveling, foundation excavation and construction, rough and fine production, machinery % equipment deployment, installation of heating, ventilation and sanitary systems, and finally, landscaping will be completed. 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 in the project site was calculated by taking into consideration the dust emission factors given in the Regulation on Industrial Air Pollution Control.

Table 65. Dust emission factors

SOURCES	UNCONTROLLED	CONTROLLED	UNIT
Removal	0.025	0.0125	kg/ton
Loading	0.010	0.005	
Unloading	0.010	0.005	
Transport (total round trip distance)	0.7	0.35	kg/km-vehicle
Storage	5.8	2.9	kg dust/ha day

Source: The "Regulation on Industrial Air Pollution Control" promulgated in Official Gazette issue no. 27277 dated 03.07.2009 (Amended Table: O.G.-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 approximately 12 months.

Topsoil

20 cm-thick topsoil will be stripped gradually prior to construction, and it will be stored temporarily in a place, the inclination of which does not exceed 5% pursuant to the standards stipulated in the "Regulation on Control of Excavation Soil, Construction And Demolition Waste", and will be used in landscaping works of the site. No crushing and grinding process shall take place for 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 = 36,705 m² x 0.20 m

Amount of Topsoil to Occur = 7,341 m³

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

Amount of Topsoil to Occur = 7,341 m³ x 1.6 ton/m³

Amount of Topsoil to Occur = 11,745 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 = 3 months, 25 days / month, 8 hours / day
 Hourly Excavation Amount = (11,745 tons / 3 months) / (25 days / month) / (8 hours / day)
 = 19.5 tons/hour

In the calculation of dust emissions will occur, the emission factors given in Table 12.6 of the "Regulation on Industrial Air Pollution Control" promulgated in the Official Gazette issue no. 27277 dated 03.07.2009 (Amended table: OG-20.12.2014-29211) (refer to 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.

Mass flow of dust emission in removal + loading + unloading of topsoil

Uncontrolled:

E₁ = 19,58 ton/hour x (0.025+0.01+0.01) kg/ton= 0.88 kg/hour

Controlled:

$$E_1 = 19,58 \text{ ton/hour} \times (0.0125+0.005+0.005) \text{ kg/ton} = 0.44 \text{ kg/hour}$$

Mass flow of dust emission in transport 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 determined by assuming that each truck that used for transportation can carry 25 tons of material and therefore 1 trip can be completed in approximately 1.5 (25 tons / 19.58 ton/hour) hours;

Uncontrolled:

$$E_2 = (0.7 \text{ kg/km}) \times (0.2 \text{ km/1 trip}) \times (1 \text{ trip/1.5 hour})$$

$$E_2 = 0.09 \text{ kg/hour}$$

Controlled:

$$E_2 = (0.35 \text{ kg/km}) \times (0.2 \text{ km/1 trip}) \times (1 \text{ trip/1.5 hour})$$

$$E_2 = 0.05 \text{ kg/hour}$$

Mass flow of dust emission while storing the topsoil

An average of 100 m² area will be used for storage of topsoil.

Uncontrolled:

$$E_3 = (5.8 \text{ kg/ha-day}) \times (0.01 \text{ ha/ 3 month / 25 day/month / 8 hour/day})$$

$$E_3 = 0.000096 \text{ kg/hour}$$

Controlled:

$$E_3 = (2.9 \text{ kg/ha-day}) \times (0.01 \text{ ha/ 3 month / 25 day/month / 8 hour/day})$$

$$E_3 = 0.000048 \text{ kg/hour}$$

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:

$$E_{\text{TOTAL-1}} = 0.88 \text{ kg/hr} + 0.09 \text{ kg/hr} + 0.000096 \text{ kg/hr}$$

$$E_{\text{TOTAL-1}} \approx 0.97 \text{ kg/hr as a result.}$$

Controlled:

$$E_{\text{TOTAL-1}} = 0.44 \text{ kg/hr} + 0.05 \text{ kg/hr} + 0.000048 \text{ kg/hr}$$

$$E_{\text{TOTAL-1}} \approx 0.49 \text{ kg/hr as a result.}$$

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 0.97 kg / h for the uncontrolled situation and 0.49 kg / h for the controlled situation.

Amount of excavation soil

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

10,070 m³ of excavation will be carried out in the project site.

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 (tons) = Area x Specific Gravity

$$\begin{aligned}\text{Total amount of excavation (tons)} &= 10,070 \text{ m}^2 \times 1.6 \text{ ton/m}^3 \\ &= 16,112 \text{ ton}\end{aligned}$$

The construction work to be carried out in the project site is expected to take approximately 12 months.

$$\begin{aligned}\text{Working Hours} &= 9 \text{ months, 25 days / month, 8 hours / day} \\ \text{Hourly Excavation Amount} &= (16,112 \text{ tons} / 9 \text{ months}) / (25 \text{ days / month}) / (8 \text{ hours / day}) \\ &\approx 8.95 \text{ ton/hour}\end{aligned}$$

In the calculation of dust emissions will occur, the emission factors given in Table 12.6 of the "Regulation on Industrial Air Pollution Control" promulgated in the Official Gazette issue no. 27277 dated 03.07.2009, and the results were evaluated within the framework of 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 removal, loading and unloading of excavation material:

As a measure against dust emission while loading and unloading, slow loading and unloading without tossing would lead to some decrease in dust emissions.

Uncontrolled:

$$E_1 = 8.95 \text{ ton/hour} \times (0.025 + 0.01 + 0.01) \text{ kg/ton} = 0.40 \text{ kg/hour}$$

Controlled:

$$E_1 = 8.95 \text{ ton/hour} \times (0.0125 + 0.005 + 0.005) \text{ kg/ton} = 0.20 \text{ kg/hour}$$

Dust emission during transport of excavation material:

Any surplus excavation material extracted from the site will be accumulated in a suitable place within the site and then reused for foundation landfill and land smoothing.

The length of the road in which the excavation surplus material will be carried within the project site is 100 m on average. Therefore, the distance to carry the excavation material is 0.2 km from the average (round trip).

The mass flow rate of the dust emission during transport determined by assuming that each truck that used for transportation can carry 25 tons of material and therefore 1 trip can be completed in approximately 3 (25 tons / 8.95 ton/hour) hours;

Uncontrolled:

$$E_2 = (0.70 \text{ kg/km}) \times (0.2 \text{ km/1 trip}) \times (1 \text{ trip/3 hours}) = 0.05 \text{ kg/hour}$$

Controlled:

$$E_2 = (0.35 \text{ kg/km}) \times (0.2 \text{ km/1 trip}) \times (1 \text{ trip/3 hours}) = 0.02 \text{ kg/hour}$$

Mass flow of dust emission while storing the excavation surplus material

Any surplus excavation material extracted from the site will be accumulated in a suitable place within the site and then reused for foundation landfill and land smoothing. In this context, it is foreseen that an area of 100 m² will be used for the storage of excavation material within the project site;

Uncontrolled:

$E_3 = (5.8 \text{ kg/ha-day}) \times (0.01 \text{ ha/ 9 month / 25 day/month / 8 hour/day})$ $E_3 = 0.000032 \text{ kg/hour}$

Controlled:

$E_3 = (2.9 \text{ kg/ha-day}) \times (0.01 \text{ ha/ 9 month / 25 day/month / 8 hour/day})$ $E_3 = 0.000016 \text{ kg/hour}$

Accordingly, the total mass flow rate of dust emission from excavation works;

Uncontrolled:

$E_{\text{TOTAL-1}} = 0.40 \text{ kg/hr} + 0.05 \text{ kg/hr} + 0.000032 \text{ kg/hr}$

$E_{\text{TOTAL-1}} \approx 0.45 \text{ kg/hr}$ as a result.

Controlled:

$E_{\text{TOTAL-1}} = 0.20 \text{ kg/hr} + 0.02 \text{ kg/hr} + 0.000016 \text{ kg/hr}$

$E_{\text{TOTAL-1}} \approx 0.22 \text{ kg/hr}$ 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. As specified in Annex 2 of the "Regulation on Industrial Air Pollution Control", contribution to air pollution is required to be calculated for new facilities if mass flow stipulated 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 0.45 kg/hour for the uncontrolled situation.

Therefore, contribution to air pollution was not required to be calculated by an internationally recognized distribution model within the sphere of influence of the plant if pollutants' mass flow stipulated in Annex-2 is exceeded for new facilities as stated in Annex 2 of the RIAPC.

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. The provisions of the "Regulation on Control of Excavation Soil, and Construction and Demolition Wastes" promulgated in the Official Gazette issue no. 25406 dated March 18, 2004 shall be complied with during the excavation.

The following amendments to the "Regulation on Industrial Air Pollution Control" (RIAPC) promulgated in Official Gazette issue no. 27277 dated 03.07.2009 shall be complied with during every stage of the project:

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

Dust-emitting mechanical processes such as crushing, grinding, transporting, storage shall not be performed during the construction of the infrastructure. Materials and equipment required will be supplied from the local 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 activity, which is the subject of the project, is planned to be carried out on the 36,705.33-m² area in total composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm.

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.

Underground and surface water resources and soil shall be prevented from polluted by disposing of the solid and liquid wastes that will occur during the operation within the regulatory framework.

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 stream 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

Prior to the beginning of the construction of the project, an application for a "Permit for Non-agricultural Use" shall be submitted to the relevant Provincial Directorates 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.

In order to use agricultural lands under the project for non-agricultural purposes to prepare the land and provide the necessary land for construction, necessary permits shall be obtained from Aydın Provincial Directorate of Food, Agriculture and Livestock and/or the Ministry of Food, Agriculture and Livestock pursuant to the Soil Conservation and Land Use Law no. 5403 promulgated in the Official Gazette issue no. 25880 dated 19.07.2005.

No non-agricultural activities shall be carried out in the project site during the process of obtaining legal permits.

No harmful substances shall be discharged to the receiving environment and no water pollution shall be caused during construction and operation pursuant to article 20 of Fisheries Law no. 1380 and articles 11 and 12 of the Fisheries Regulation.

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.

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.

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 be no woodcutting related to forest areas due to the absence of any forest assets and trees in the project site and its vicinity.



Figure 95. View from the project site, May, 2016

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 site.

The project site is not located within the forest area. It is 1.5 km from the nearest forest area to the project site.

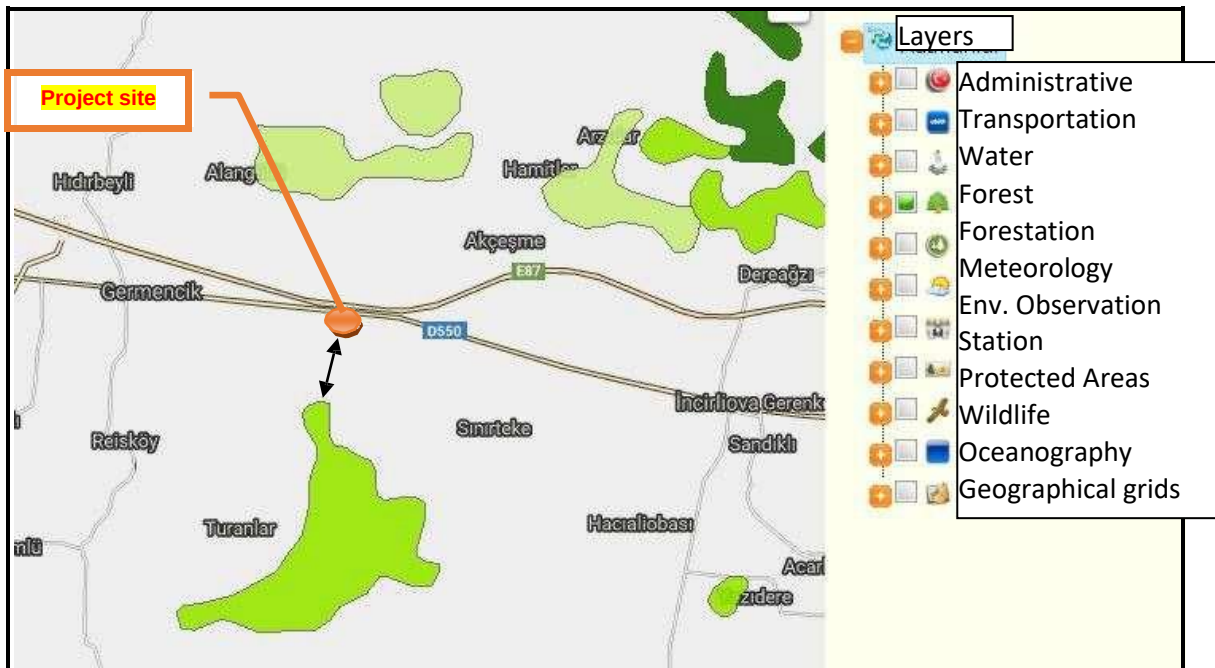


Figure 96. Project site and the closest forest areas

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 making a fire in the field and leaving the flammable substances on the field. It will be acted in accordance with the 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 fires.

III.1.12. Water supply system plan, where from to supply; types and amounts of wastewater, disposal methods, discharge areas

Staff's water requirement

During the construction phase of the facility, two types of water will be needed for the personnel's use of potable and utility water and dust suppression.

During the construction phase, the need for potable and utility water for the personnel will be provided by means of carboys and tankers, respectively.

Potable and utility water during construction phase shall be provided in accordance with the provisions of the Turkish Ministry of Health's "Regulation on Water for Human Consumption" promulgated in the Official Gazette issue no. 25730 dated 17.02.2005 and the Regulation on Amendment to the "Regulation on Water for Human Consumption" promulgated in the Official Gazette issue no. 28580 dated 07.03.2013. A letter from Aydın Metropolitan Municipality stating that utility water will be supplied is given in Annex-24.

It is foreseen that 400 people will work during the construction phase of the activity. Assumed that the daily water consumption per person for these personnel is 181 L ²⁷:

Amount of water use of personnel=(amount of water use per person) x (number of personnel)

$$\begin{aligned} \text{Personnel water usage} &= 181 \text{ L/day} \times 400 \text{ persons} \\ &= 72,400 \text{ tons/day} \\ &= 72.40 \text{ m}^3/\text{day}. \end{aligned}$$

²⁷ Source: TÜİK, Municipal Water Statistics-2014.

The number of personnel, which is 400, specified in the construction phase of the project refers to the total number of personnel to be employed in all construction works. And, less than 400 personnel will work at the same time in the field of activity during the implementation.

All the provisions of the Water Pollution Control Regulation promulgated in the Official Gazette issue no. 25687 dated 31.12.2004 (amended by OG 26786 dated 13.02.2008, OG 27537 dated 30.03.2010, OG 27914 dated 24.02.2011, and OG 28244 dated 25.03.2012) shall be complied with while disposing of liquid wastes to be generated during the construction phase of the project.

Domestic wastewater, which will emerge during the land preparation, construction and operation phases, will be collected in a septic tank and will be disposed of by the sewage trucks in certain periods in return for a fee and discharged to a treatment plant. Aydın letter from Aydın Metropolitan Municipality stating that the domestic wastewater will be disposed of by sewage trucks is given in Annex-23.

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

400 people will work during the construction phase of the intended project. Therefore, domestic solid waste will be generated by the personnel to be employed. During the construction phase of the project, assuming that 1.16 kg solid waste will be generated a day per person ²⁸, the following amount of solid waste has been calculated.

$$\begin{aligned}\text{Amount of domestic solid waste to be generated} &= 400 \text{ persons} \times 1.16 \text{ kg/day-person} \\ &= 464 \text{ kg/day.}\end{aligned}$$

The number of personnel, which is 400, specified in the construction phase of the project refers to the total number of personnel to be employed in all construction works. And, less than 400 personnel will work at the same time in the field of activity during the implementation. A letter from Aydın Metropolitan Municipality stating that utility water will be supplied is given in Annex-24.

Domestic solid wastes generated by the personnel during the operation phase of the activity shall be collected in separate containers based on their characteristics (organic, glass, plastic, paper, metal, etc.) and kept in sealed containers within the project site without polluting the environment in terms of appearance, dust, odor, etc. The solid wastes to be collected in containers shall be disposed of by being delivered at certain intervals to the solid waste collection system of Germencik Municipality, which is the closest municipality.

The provisions of the "Waste Management Regulation" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with while collecting, storing, and transporting domestic solid wastes.

Packaging waste

Recoverable wastes generated during the construction phase of the project shall be collected separately from all other solid wastes and delivered at certain intervals to a contracted company having a license for collecting packaging wastes pursuant to the "Regulation on Control of Packaging Waste" promulgated in the Official Gazette no. 28035 dated 24.08.2011 and all amendments to that regulation.

²⁸ Source: TÜİK, biruni.tuik.gov.tr.

The provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" promulgated in Official Gazette issue number 27605 dated 08.06.2010 (Amended: OG-14.6.2012-28323, OG-11.7.2013-28704) shall be complied with during the work.

Formation of waste oil and hazardous waste

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 of within the framework of the relevant regulations.

The provisions of the "Regulation Waste Oil Control" promulgated in the Official Gazette no. 26952 dated 30.07.2008 (Amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812) shall be complied with during all the works to be done within the project site.

In case of a maintenance and repair procedure in the project site, it shall be carried out in a sealed area, and the provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" promulgated in Official Gazette issue number 27605 dated 08.06.2010 (Amended: OG-14.6.2012-28323, OG-11.7.2013-28704) shall be complied with during the work.

In addition, the provisions of the "Waste Management Regulation" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with for any hazardous wastes occurring in any stage 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, battery replacements will also take place outside the plant. Each accumulator will be delivered to the service station from which the new accumulator is purchased.

However, in the event of any battery replacements in the project site in case of an emergency, waste accumulators shall be stored temporarily in a sealed indoor setting within the project site, and it shall be ensured that they are disposed of by being delivered to a recovery/recycling company licensed by the Ministry of Environment and Urbanization pursuant to the provisions of the "Regulation on Control of Waste Batteries and Accumulators" (Amended: O.G. - 03.03.2005/25744, O.G. - 30.03.2010/27537, O.G. - 5.11.2013-28812, O.G. - 23.12.2014- 29214) promulgated in the Official Gazette issue no 25569 dated 31.08.2004.

The provisions of the "Regulation on Waste Landfill" (Amended: O.G. 11.03.2015 – 29292) entered into effect on 01.04.2010 and promulgated in the Official Gazette issue no. 27533 dated 26.03.2010 and the "Regulation on Control of Waste Batteries and Accumulators" (and all the amendments to the regulation) promulgated in the Official Gazette issue no. 25569 dated 31.08.2004 shall be complied with during the construction phase of the intended activity.

End-of-life tires

Tires likely to result from the vehicles to be operated during the operation phase of the activity shall be disposed of by being stored temporarily in an enclosed and sealed place within the project site and delivered to a company licensed by the Ministry of Environment and Urbanization pursuant to the provisions of the "Regulation On Control Of End-Of-Life Tires" promulgated in the Official Gazette issue no. 26357 dated 25.11.2006 (Amended: OG-30.03.2010-27537, OG-10.11.2013-28817, OG-11.3.2015-29292).

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 healthcare facilities located in the nearest settlements. Although the amount of wastes to be occurred in the plant in this context 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 colored plastic bags which are resistant to puncturing, tearing, exploding; made of original medium-density polyethylene, leak-free, with double bottom seam, with sufficient capacity to carry at least 10 kg and with double layer thickness of 100 micron, without bellows, with "International Biohazard" emblem and "ATTENTION! MEDICAL WASTE" phrase. Bags shall be filled maximum to $\frac{3}{4}$ level, and their openings shall be tightly tied; and in case deemed required, each bag shall put into another bag with the same specifications to ensure sealing. The contents of medical waste bags will never be compressed; medical wastes will not be removed from the bag, or unloaded or transferred to another container.

Wastes with cutting-puncturing features shall be separated from other wastes and placed in plastic or laminated cardboard boxes which are resistant to puncturing, tearing, cracking, exploding, and are water-resistant and leak free, impossible to open and touch the contents, with "International Biohazard" emblem and "ATTENTION! SHARP MEDICAL WASTE" phrase, 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 never be compressed, opened or emptied.

The provisions of the "Regulation on Control of Medical Waste" promulgated by the Official Gazette issue no 29959 dated 25.01.2017 shall be complied with throughout the entire project.

III.1.14. Vibration, sources and level of noise, cumulative values, measures to be taken

In the land preparation and construction phase of the intended project, there will be ambient noise induced by construction machinery and equipment to be operated within the field.

The characteristics of the machinery and equipment that may cause noise during the construction phase of the project are given in Table 66. The distribution of the average sound pressure levels to be obtained from the mentioned vehicles depending on distance is shown in Table 67, whereas the distribution graph is shown in Figure 103.

Table 66. Quantities and specifications of machinery & equipment to be employed during the construction phase

MACHINERY-EQUIPMENT	QUANTITY	SOUND POWER LEVEL (dBA)
Excavator	1	105
Loader	1	113
Trucks	4	94
Roller	1	94
Cement mixer truck	1	108
Concrete pump	1	94
Diesel crawler crane	1	105

Excavator (trench excavator)

The total noise level of an excavator (trench excavator) is 105 dBA, the distribution of which by frequencies are given in the following figure.

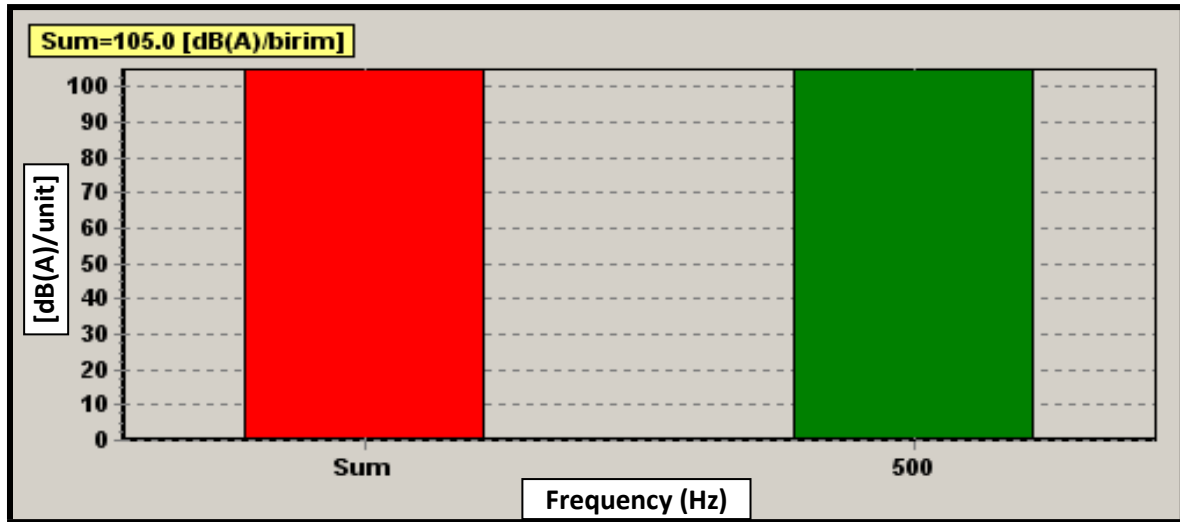


Figure 97. Frequency analysis on levels of noise from an excavator

Loader (wheeled loader < 110 kW)

The total noise level of a loader (wheeled loader < 110 kW) is 113 dBA, the distribution of which by frequencies are given in the following figure.

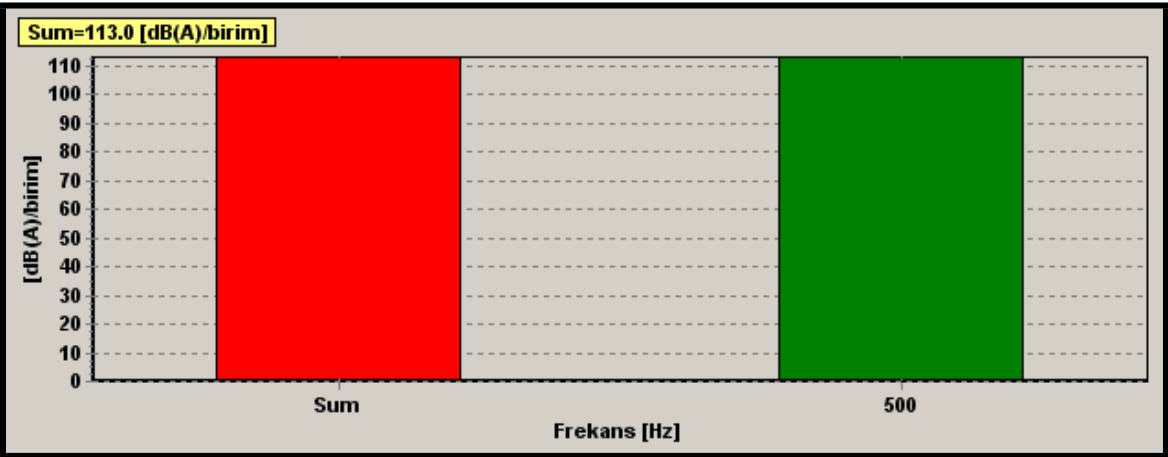


Figure 98. Frequency analysis on levels of noise from a loader

Dump truck

The total noise level of a dump truck (neutral) is 94 dBA, the distribution of which by frequencies are given in the following figure.

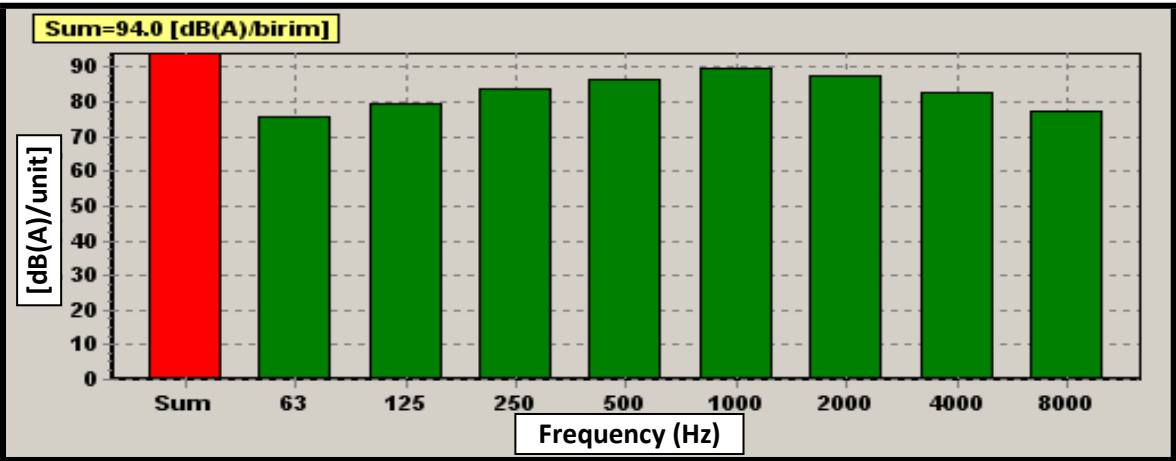


Figure 99. Frequency analysis on levels of noise from a truck

Concrete mixer (150 - 500 l, mec.filling)

The total noise level of a concrete mixer (150 - 500 l, mec.filling) is 108.0 dBA, the distribution of which by frequencies are given in the following figure.

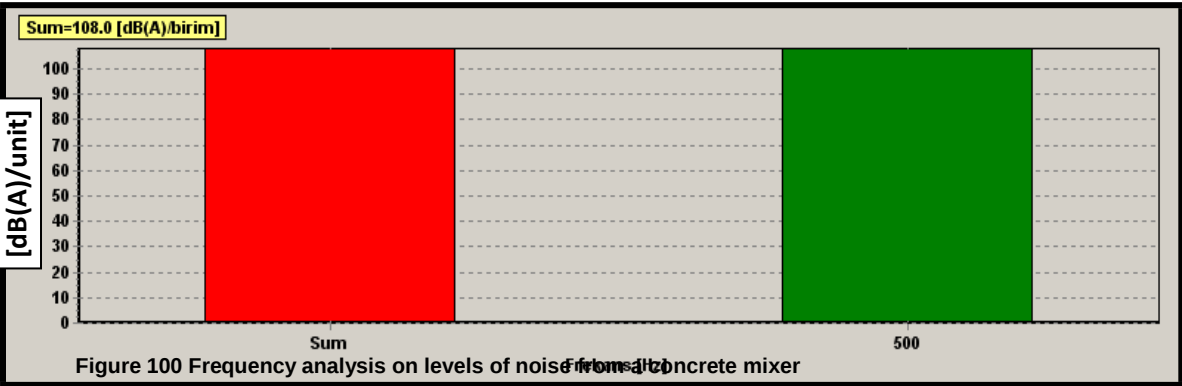


Figure 100 Frequency analysis on levels of noise from a concrete mixer

Diesel crawler crane (construction crane: > 80 kW)

The total noise level of a diesel crawler crane (construction crane) is 105.0 dBA, the distribution of which by frequencies are given in the following figure.

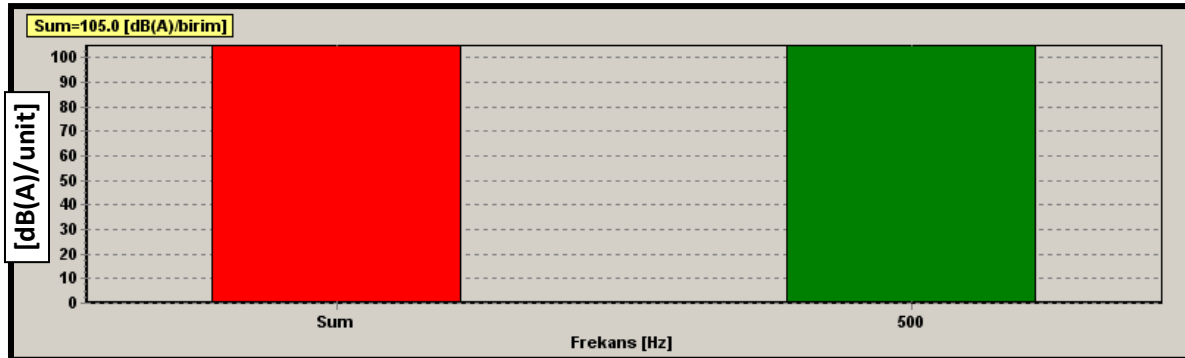


Figure 101 Frequency analysis on levels of noise from a crawler crane

Noise will be generated by construction machines to be operated during the land preparation and construction phase of the project. Calculation of sound pressure level which will occur when considering the most adverse conditions:

$$L_{pt} = 10 \log \left(\sum_{i=1}^n 10^{L_{pi}/10} \right), \text{ this formula is used.}$$

In the formula,

L_{pt} = Total sound pressure level,

L_{pi} = Sound pressure level from every construction machine.

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”, denoted 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.

$$A_{atm} = 7.4 \times 10^{-8} \times f_2 \times r / \phi$$

In the formula,

A_{atm} = Decrease in sound pressure level by atmospheric

touchup (dBA) f = Frequency of transmitted sound (3500)

r = Distance from source (m)

ϕ = Relative humidity of air (68.7%)⁽²⁹⁾

The following formula is used in the calculation of the volume (noise) level.

²⁹ Aydın weather station, 1960-2015

$$L = L_{pt} - A_{atm} + DF$$

In the formula,

L = Sound (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. 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.

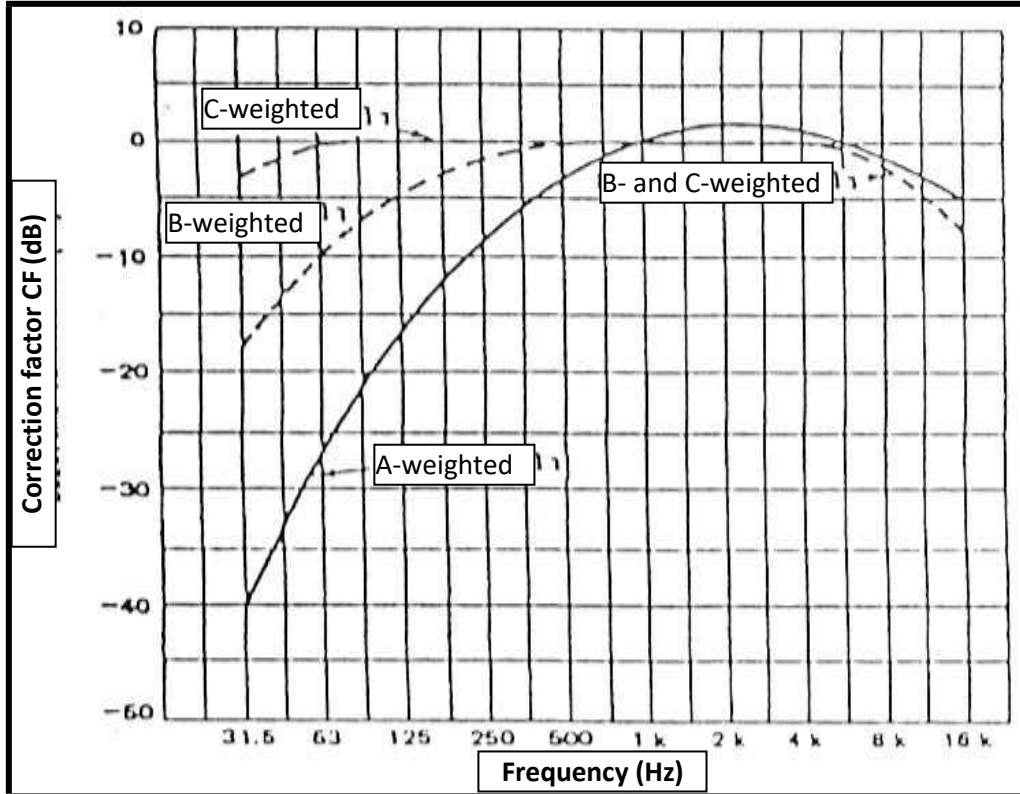


Figure 102 Cycle curves for A-, B-, and C-weight sound (noise) levels

Source: Özgüven, N. (Prof. Dr.), Industrial Noise Control

Table 67. Distance wise distribution of Average Levels of Pressure of Sound from all sources during the construction phase

r (m)	L _{PT} (dBA)	Aatm (dBA) (f:500)	DF (dBA) (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)	L _T (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

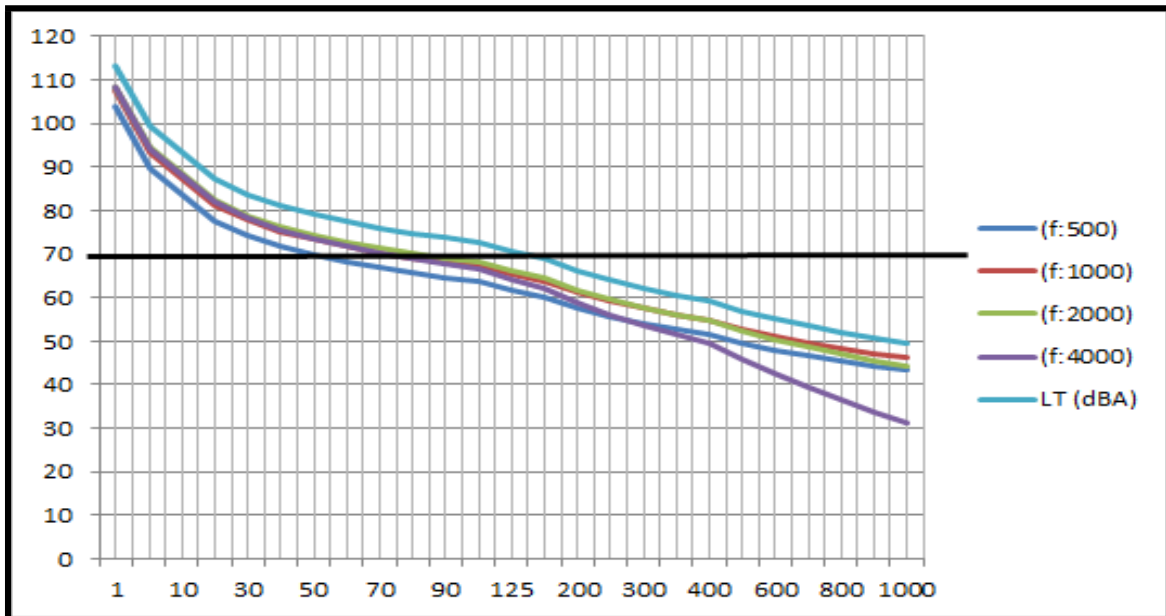


Figure 103 Distance wise distribution of Average Levels of Pressure of Sound from all sources during the construction phase

Conclusion and evaluation

Ambient noise levels for construction sites and the maximum noise levels acceptable in terms of noise prevention stipulated in the "Regulation on Assessment and Management of Ambient Noise (RAMAN) promulgated in the Official Gazette no. 27601 dated 04.06.2010 are given in Table 68.

Table 68. Ambient noise limit for the construction site

Type of activity (construction, demolition and repair)	L _{day} (dBA)
Buildings	70
Roads	75
Other sources	70

Comparing the noise levels during the construction phase given in the table with the noise levels stipulated in Table 5 of Annex-VII of RAMAN, it is observed that 70 DBA limit values were obtained after about 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 causing noise will be regularly maintained and renewed after their economic life is over. 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 to be employed during the construction phase of the project are planned to be supplied locally. 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. As for the drilling works, workers will meet their needs through the portable containers (administrative-social building) to be erected at well locations.

Facilities 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 intended 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 personnel 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 shall be taken in the facility area and guards shall be kept available at all times.

There shall 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 stipulated 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 available in the facility. In case of more severe injuries and accidents, the person will be immediately sent to the healthcare facilities located 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 an 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 spread 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.
- Pre-activity training will be given to the personnel to make them consciously (not to build a fire or hunt, etc.) during the construction.

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.), plant and tree species to be selected

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 intended 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 GPP site prior to construction activities in the selection of plant material is important for the preservation of habitat relations. However, due to the slow growth problem of these species in terms of their physiological characteristics as well as procurement problems, different species can be selected. Many factors need to be considered while selecting plants to be used in the landscape repair process. These factors can be grouped under the following headings (Güney 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 restrictive characteristics such as maximum and minimum temperatures, precipitation amount, soil and air humidity, salinity, lime content, wind, soil pH, air, soil and water pollution play an important role in selection.

- 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 over-ground parts preventing water and soil movements on the surface, and can spread to the area with rhizome and stolons should be available. He growth rate should not be slow and the branches should not be fragile.

- Cultural criteria: The plant selected should be produced abundantly depending on the size of the area and should not require special devices, structures or chemical materials. Both at the production site and where they are planted, minimum care should be needed.

- Economic criteria: The basic principle should be the procurement of plants in the most economical manner to the implementation area. Cheapest equivalent plants that can be procured easily and planted most economically having the highest chance of survival with minimum transportation costs should be preferred.

The target is to rebuild the ecological systems by using the “Natural Landscape Arrangement” methods after the construction phase. After the construction, the first work to be carried out within the scope of reinstatement of the fields of activity will recovering the levelling of the land. It shall be tried to adapt the natural land around the site as much as possible while recovering the original leveling of the areas the topography of which is expected to be deteriorated within the scope of the Efe-8 GPP project.

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 opsoil stripping will be started.

Stripping of the upper soil, taking the erosion and sedimentation measures during the construction period, land leveling, top soil laying, are planting are steps to be followed.

Plants to be used in landscape repair works are expected also 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 site 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 efforts, there will be no environmental impact to these flora species during construction and operation phases.

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 dusting, irrigation will be applied during the construction and operation phase, so it shall be ensured that the wetlands that can be used by the fauna and flora is affected by dust.

Care shall be taken to minimize the noise during the periods of the construction season that coincide with the incubation/reproduction period, if deemed necessary.

During the operation and excavation phases, 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, the 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, vulnerable, and protected is identified within the project site, the relevant regulations will be followed; such species shall be protected in accordance with the measures of the Land Hunting Law and Regulation no. 4915 and international conventions (Bern and CES convention).

There are no areas of high landscape value or recreation areas in the project site 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.

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.

III.1.21. Other issues

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 perform in which units, capacities, amount of energy to be generated, how to transmit the energy to be generated, operating times of the power plant

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 to generate electricity.

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 heat of the geothermal fluid is loaded to a second fluid having a low liquefying heat such as pentane, izo-pentane, and izo-butane in the 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 Rankine cycle is repeated closed -loop and energy generation is continued by means of liquefaction in the condenser to get into the cycle again from the turbine outlet.

A Binary Power Plant consists of two parts.

1-Electricity generation section: generates electricity by means of Organic Rankin Cycle from the fluid heat (ORC - Organic Rankin Cycle)

2-Auxiliary services section: The BOP (Balance of Plant) section compose of production wells from which the fluid is supplied, transmission pipelines, lift pumps, and the reinjection system.

The main point of 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, design of the condenser 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, a double-fluid-binary system has been 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.

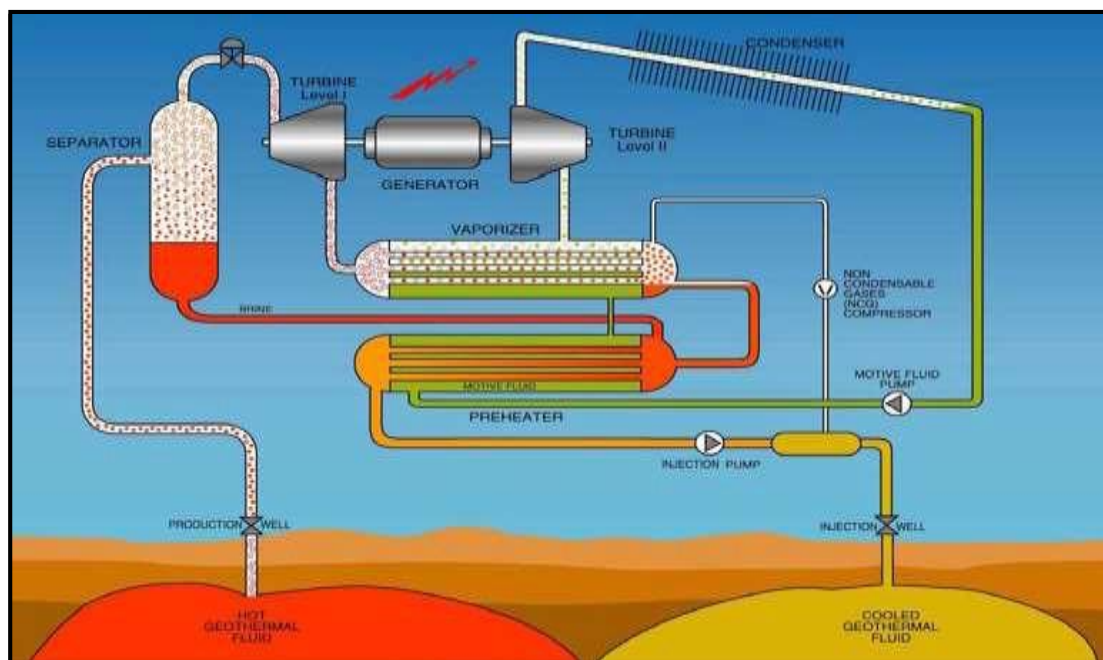


Figure 104 Schema of the general working principle of the power plant

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 delivery 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 generated. The low pressure pentane vapor, which is converted to energy in the turbines, goes to the air-cooled condenser and liquefies. The liquefied pentane is again pumped into the preheaters.

Electrical energy to be generated by means of a binary system within the scope of Efe 8 Geothermal Power Plant shall be transmitted from the switchyard existing within Efe Geothermal Power Plant to the 154-kV Gürmat I Feeder.

The total installed capacity of the power plant is 50 MWe. The approximate amount of energy intended to be generated annually within the scope of the project is 400,000,000 kW.

The units of the plant and their descriptions are given below.

Turbines, generator

High-pressure secondary work fluid in the gas phase arriving the turbines enters the turbine to turn the turbine blades and the kinetic energy produced in this way is converted into electrical energy in the generator. System control will be ensured by equipping every turbine inlet with control valves. The cooling water system that provides cooling of the bearings and oil in the system will provide cooling of the bearing components and oils of the turbine and generator.

Production and injection system

In this system, the geothermal fluid is collected from the production wells and transported to the separation station. The gas and liquid geothermal fluid separated here from each other is sent to the evaporator.

The secondary work fluid becomes hot in the evaporator. The liquid geothermal fluid from the evaporator is sent to the preheaters, so that the secondary work fluid is passed to the gas phase. The liquid geothermal fluid from the preheater conveyed to injection wells and reinjected to the reservoir by means of reinjection pumps.

Uncondensed gas discharge system

Uncondensed gases from the evaporator are removed from the system by means of a silencer on the air-cooled condenser.

Air-cooled condenser

This system is used to cool the secondary work fluid from the turbine and convert it into a liquid phase.

Circulation pump and recuperator

The secondary work fluid in gas phase exiting from the air-cooled condenser is directed to the recuperator by means of circulating pumps, and it is loaded with the heat energy of the secondary work fluid in gas phase directed to the air-cooled condenser in the recuperator and continues its movement towards the pre-heater.

Auxiliary systems

In addition to the abovementioned main systems, some auxiliary systems have been designed to provide the necessary system for supplying the required running water for the plant site and the fire protection of the plant equipment. It consists of running water supply, fire response systems, and a fire water storage tank.

Instrument control system of the power plant

The plant control and protection system, which is established for the purpose of protection, automation and control room of the plant, is a system consisting of monitoring instruments and control valves and panels.

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

These systems consist of tubular materials and brackets used in the construction of geothermal wells, wellhead main valves to be used at wellheads to control and regulate the flow, inhibitor systems preventing in-pipe incrustation, check valves, and silencers and flumes used for test procedures.

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 geothermal fluid to be produced at a maximum rate about 2,500 tons/hour by 9 production wells of Gürmat Elektrik Üretim A.Ş. is planned to be used by Efe-8 Geothermal Power Plant.

The geothermal source used under the project will be re-injected to underground by means of 8 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 site.

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 contact with the wells in any way and will be transferred to the plant in closed-system pipes.

Pentane will not be kept in the construction site for a long period of time and will always be delivered to the system in one week at the latest. Only a small amount of pentane, which is called make-up, will be kept 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, waste mud that may occur and the resulting geothermal liquid; in well locations suitable for the system, the mud 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 power generation in project units, transportation, storage, their impacts during transportation and storage

No hazardous, toxic, flammable and explosive substances shall be used during the production in the intended 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 taken pursuant to the provisions of the "Regulation On Measures To Be Taken In Workplaces And Works With Flammable, Explosive, Dangerous And Harmful Substances" promulgated in the Official Gazette issue no. 7551 dated 27.11.1973.

All operations related to the handling, transportation and storage of 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. The content of the noncondensable gases during the operation phase of the Geothermal Power Plant can be listed as follows: CO₂, N₂, CH₄, NH₃, H₂S, O₂, and H₂. Approximately 99% of the volume is CO₂, whereas other gases are present in trace amounts.

During the operation phase of the project, emissions from the cooling tower are expected.

Possible emissions from the operational phase of the project are as follows: CO₂, N₂, CH₄, NH₃, H₂S, and H₂. CO₂, which is approximately 99% by volume, has an important place compared to other gases.

Table 2.1 in Annex-2 of the "Regulation on Industrial Air Pollution Control" promulgated in Official Gazette issue no. 27277 dated 03.07.2009 stipulates a limit only for H₂S.

Table 69. H₂S air quality limits

Parameter	Duration	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	20	20	20

Source: Regulation on Industrial Air Pollution Control

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 RIAPC 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 licensed field 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 Industrial Air Pollution Control. In this context, 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 mating surfaces as well as 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 intended project is based on the transfer and separation of the geothermal fluid obtained from the production wells to the pressure separators and the conversion of the mechanical energy occurring as a result of the tribulation of the steam in this unit, into electrical energy and transmission of the same to the switchyard by means of the generators. The machinery and equipment intended to be used in the plant are listed below:

- Inhibitor dosing system
- Wellhead check valves
- Separator
- Balancing tank
- Filters
- Pumps
- Measuring equipment
- Manual valves
- Safety equipment
- Compressor

- Driver panels
- Automation panel

Machinery and equipment to be used in the wellhead facilities of reinjection wells:

- Reinjection pumps
- Manual valves and check valves
- Measuring equipment
- Safety equipment
- Driver panels
- Automation panels
- Frequency control equipment panel
- Breaker cells
- Transformer

Machinery and equipment to be used in the plant:

- Exchangers
- Recuperators
- Turbine
- 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 generation 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, therefore the 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, the "reinjection" method will be employed in order to prevent the reservoirs of the production wells 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.

As the geothermal fluid used in the facility is re-injected to 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 means of reinjection. Thus, surface collapses occurring as a result of decrease in reservoir volume because of production will be minimized.

Within the scope of the project, 9 production and 8 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 70. Information on reinjection wells

	Order	Well name	Status
Reenjeksiyon Kuyuları	1	OB-21	Existin
	2	OB-21A	Existin
	3	OB-21B	Existin
	4	OB -21C	Existin
	5	OB -23	New
	6	OB -23A	New
	7	OB -23B	New
	8	OB -23C	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 potential failures in the closed circuit of the source can be seen immediately in the control center through the automation system and can be intervened from there. For the possible malfunctions in the reinjection system, a 7,500 m³ storage pool in the existing Efe 1-3-4 GPP campus will be used. The pool will be able to store 2,500 tons/hour of geothermal source to be used in the system for 3 hours. In case of prolongation of a malfunction, production wells shall be shut down through the automation system and the flow of geothermal sources 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 contained by heated fluids within reservoirs created by permeable rocks within the accessible depths of the earth's crust.

The geothermal fluid will be re-injected to the geothermal reserves in order to qualify the sustainability of the geothermal power plant and maintain the energy of the reserve.

The geothermal source 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. 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.

7,500-m³ storage pool will be used in case the power plant is deactivated as a result of any problem related to reinjection or the power plant. Geothermal liquid will be stored in the mentioned pool until the problem of reinjection is resolved. After the technical problem is resolved, the water collected in the pool will be transmitted into the reinjection system without being discharged again to the receiving environment.

During the works to be carried out within the scope of the project, the provisions of Law on Groundwater, Regulation 28257 on Protection of Groundwater from Pollution and Degradation dated April 7, 2012, and Regulation on Control of Water Pollution shall be complied with.

During the construction and operation phase of the project, material and waste shall not be dumped into the surrounding stream 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.

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. Approximately 70% of the national geothermal potential is within the depression area called Büyük Menderes Graben between the districts Aydın-Ortaklar and Denizli-Sarayköy. The most important underground wealth of Aydın is geothermal energy sources. Although in many regions, especially the Germencik-Ömerbeyli geothermal field known as geothermal field in Turkey with the highest temperature, which is 230 °C. The geothermal fields in Aydın and the usage conditions of these sites are given as follows.

NAME OF GEOTHERMAL SITE	NAME OF NATURAL HOT WATER OUTLET	NATURAL OUTLET			DRILLING			AREA OF USE	ERECTED FACILITY	DEĞ. BEL.
		Temp. (°C)	Flow R. (l/sec)	Potential (MWt)	Temp. (°C)	Flow R. (l/sec)	Potential (MWt)			
YILMAZKÖY	Ilıcabaşı	34-38	1,1		84-142	47	19	Hot springs or heating hot spring facilities	-	***
GERMENCİK- ÖMERBEYLİ	Ömerbeyli Sahası				203- 232	725	594,83	Electricity generation, and other implementations depending on reinjection wells, urban heating-cooling, greenhouse heating, fruit drying (fig, grape), textile industry (yardn), cold storage, hot springs or heating hot spring facilities	-	***
BOZKÖY-ÇAMUR	Bozköy-Çamur	36-92	4		59-142	280	107	Hot springs or heating hot spring facilities	Hot spring	***
SALAVATLI	Salavatlı				167- 172	93,8	53,79	Electricity generation and other implementations depending on reinjection wells, urban heating and cooling, greenhouse heating, fruit drying, industrial process heating, hot springs or heating hot spring facilities	Hot spring	***
SULTANHISAR	Sultanhisar				145- 146	200	89			
MALGAÇEMİR- GÜVENDİK	Güvendik	38	0,5					Thermal tourism		
ORTAKLAR-GÜMÜŞ	38,7							Hot springs, hot spring facilities and greenhouse heating	Hot spring	***
SÖKE-SAZLIKÖY	Sazlıköy	27								
KUŞADASI	Ilıca		-	-	26	3	-	Hot springs, hot spring facilities and greenhouse heating	-	**
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	Heating, thermal tourism		

MTA, 1996, Geothermal inventory of Turkey
 * MTA, 2005, Geothermal sources inventory of Turkey
 ** DPT, 2001, Mining specialization commission of the 8th five-year development plan, Sub-commission for nergy raw materials, Report of geothermal energy work group
 Note: Potentials in drillings have been calculated according to the total of initial production flow rates of the wells
 1. The total of initial production flow rates of the wells
 2. The reservoir temperature in high-temperature (higher than 100 °C) fields

Figure 105 Geothermal sources and utilization areas in Aydın Province

Efe-8 Geothermal Power Plant is planned to be realized within the scope of "Geothermal Resources and Natural Mineral Water Operation License" no. J-553. The licensed area currently has geothermal power plants operated by the investor company. These facilities and J-553 license area are given as follows.

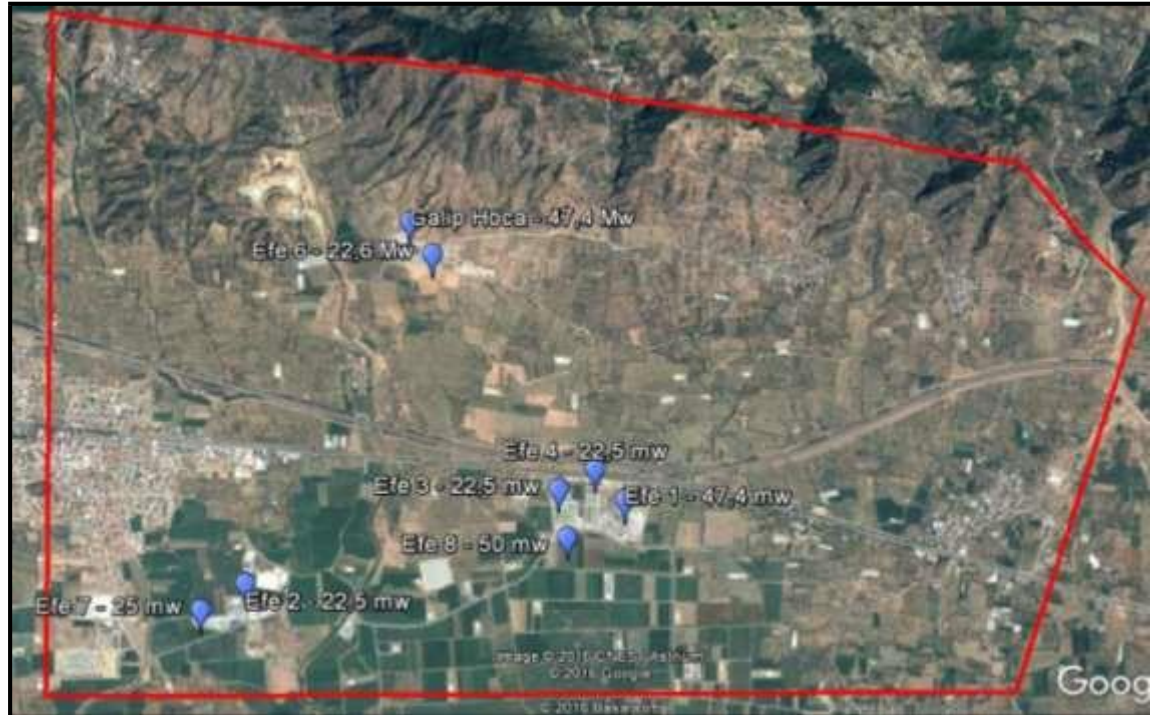


Figure 106 Geothermal power plants active in the licensed field J-553

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.

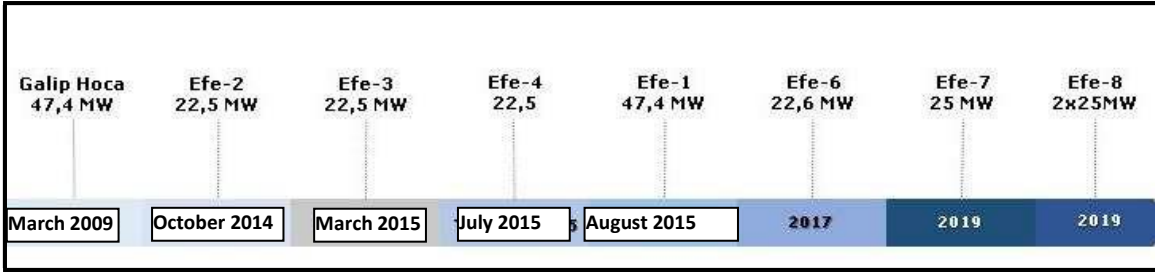


Figure 107 Current and intended operation dates of the geothermal plants within the licensed field

In the "Geothermal Resources And Natural Mineral Waters Operation License" area no. J-553, various Geophysical-geotechnical reports, consultancy reports, Social Impact Assessment Report, current situation determination studies and measurement-analysis reports, H₂S measurement report and EIA reports have been prepared by the investing company, whereas the environmental impacts reservoir utilization status, geological structure of region and integrative evaluations of facilities have been realized by qualified personnel in accordance with the scientific data of the planned and existing projects.

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 licensed field by obtaining the necessary permits from the relevant institutions/organizations within the scope of the legislation. It is observed that the intended Efe-8 Geothermal Power Plant project will not pose a problem in terms of reservoir use.

The reinjection wells have been selected for the project considering the aims of ensuring a certain amount of pressure increase and slowing down the decrease of water level, preventing land subsidence and slippage, making economical investments in reinjection wells and facilities, protecting the environment, and preserving the quality of surface water, groundwater and soil.

During the operation phase and throughout the activity period the provisions of the "Regulation on Control of Odor Forming Emissions" promulgated in the Official Gazette no. 28712 dated 19.07.2013 shall be strictly observed, and odor measurements shall be got done by competent bodies and submitted to the relevant authority, if required and/or necessary.

In all stages of the activity, the provisions of the Regulation on Industrial Air Pollution Control promulgated in the Official Gazette issue no. 27277 dated 03.07.2009 shall be observed, the measures stipulated shall be taken, and the relevant limits shall not be exceeded.

Other geothermal facilities in the region

According to the data from the Energy Market Regulatory Authority (EMRA), details of the licenses in force for the geothermal fields in Aydın province, where the project is located, are given in the table below.

Table 71. Details of licenses regarding geothermal fields in Aydın Province

Type	Status	No	Title	Name of facility	Install ed power	Install ed power
License	In force	EÜ/6619-2/03596	LİMGAZ ELEKTRİK ÜRETİM MADENCİLİK SANAYİ VE TİCARET ANONİM ŞİRKETİ	Buharkent GPP	5	5
	In force	EÜ/6550-4/03579	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	MEHMETHAN GPP	24.8	24.8
	In force	EÜ/6536-1/03575	BEŞTEPELER ENERJİ ÜRETİM TİC. A.Ş.	Kubilay GPP	24	24
	In force	EÜ/6510/03569	KEN KİPAŞ ELEKTRİK ÜRETİM A.Ş.	KEN 3 GPP	24.8	24.8
	In force	EÜ/6417-17/03539	KEN KİPAŞ ELEKTRİK ÜRETİM A.Ş.	Ken Kipaş Plant	24	24
	In force	EÜ/6255/03481	TURCAS KUYUCAK JEOTERMAL ELETRİK ÜRETİM ANONİM ŞİRKETİ	Kuyucak GPP	18.37	18
	In force	EÜ/6111-1/03447	ÇELİKLER SULTANHİSAR JEOTERMAL ELEKTRİK ÜRETİM ANONİM ŞİRKETİ.	Çelikler Sultanhisar Geothermal Power Generation	13.8	13.8
	In force	EÜ/6083-18/03439	KARKEY KARADENİZ ELEKTRİK ÜRETİM ANONİM ŞİRKETİ	Umurlu-2 GPP	12.37	12
	In force	EÜ/5898-1/03395	ÇELİKLER PAMUKÖREN JEOTERMAL ELEKTRİK ÜRETİM ANONİM ŞİRKETİ	Pamukören GPP 3	22.51	22.51
	In force	EÜ/5842-2/03366	ÇELİKLER PAMUKÖREN JEOTERMAL ELEKTRİK ÜRETİM ANONİM ŞİRKETİ	PAMUKÖREN GPP 2	22.51	22.51
	In force	EÜ/5255/03112	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	Kerem GPP	24	24
	In force	EÜ/3821-5/2327	MENDERES GEOTHERMAL ELEKTRİK ÜRETİM A.Ş.	Dora IV GPP	17	17
	In force	EÜ/3821-1/2323	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	Deniz (Maren II) GPP	24	24
	In force	EÜ/3338-1/2022	KİPER ELEKTİRİK ÜRETİM ANONİM ŞİRKETİ	Kiper GPP	20	20
	In force	EÜ/3230-2/1957	ÇELİKLER JEOTERMAL ELEKTRİK ÜRETİM ANONİM ŞİRKETİ	Çelikler Pamukören Geothermal Electricity Generation	67.53	67.53
	In force	EÜ/3094-11/1845	GÜMÜŞKÖY JEOTERMAL ENERJİ ÜRETİM ANONİM	Gümüşköy GPP	13.2	13.2
	In force	EÜ/2756-11/1704	KARKEY KARADENİZ ELEKTRİK ÜRETİM ANONİM ŞİRKETİ	Karkey Umurlu GPP	12.37	12
	In force	EÜ/2709-12/1680	MENDERES GEOTHERMAL ELEKTRİK ÜRETİM A.Ş.	Dora III GPP	34	34
	In force	EÜ/2191-2/1538	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	Maren Plant	44	44
	In force	EÜ/1435-4/1040	MENDERES GEOTHERMAL ELEKTRİK ÜRETİM A.Ş.	Dora-2 Geothermal Power Plant	9.5	9.5
	In force	EÜ/126-106/43	MENDERES GEOTHERMAL ELEKTRİK ÜRETİM A.Ş.	Dora-1	7.951	7.951

Source: Energy Market Regulatory Authority, lisans.epdk.org.tr, March, 2017

Information on the active geothermal facilities in Germencik district is given in the table below.

Table 72. Geothermal power plants active in Germencik district

No	Name of company	Location of project	Name of project	Capacity (Mwe)
1	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	Aydın Province, Germencik Distract, Bozköy-Çamur Locality Sinem GPP and İrem GPP	Sinem Geothermal Power Plant and İrem Geothermal Power Plant	20+19
2	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	Aydın Province, Germencik Distract, Bozköy-Çamur Village Vicinity (License J-552/A)	Mehmethan Geothermal Power Plant	24
3	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	Aydın Province, Germencik Distract, Bozköy-Çamur Village Vicinity (License J-552/A)	Kerem Geothermal Power Plant	24
4	MAREN MARAŞ ELEKTRİK ÜRETİM SANAYİ VE TİCARET A.Ş.	Germencik /AYDIN	Deniz Geothermal Power Plant	24
5	BEŞTEPELER ENERJİ ÜRETİM TİC. A.Ş.	Moralı köyü ve Uzunkum Köyü Civarı/Germencik	Kubilay Geothermal Power Plant	48
6	GÜRMAT ELEKTRİK ÜRETİM A.Ş.	Mesudiye Mahallesi/Germencik	EFE-1-2-3-4 Geothermal Power Plant	162.5
7	GÜRMAT ELEKTRİK ÜRETİM A.Ş.	Ömerbeyli Quarter/Germencik	Galip Hoca Geothermal Power Plant	47.4

The active geothermal power plants given in Table 72 are processed on the satellite view below.

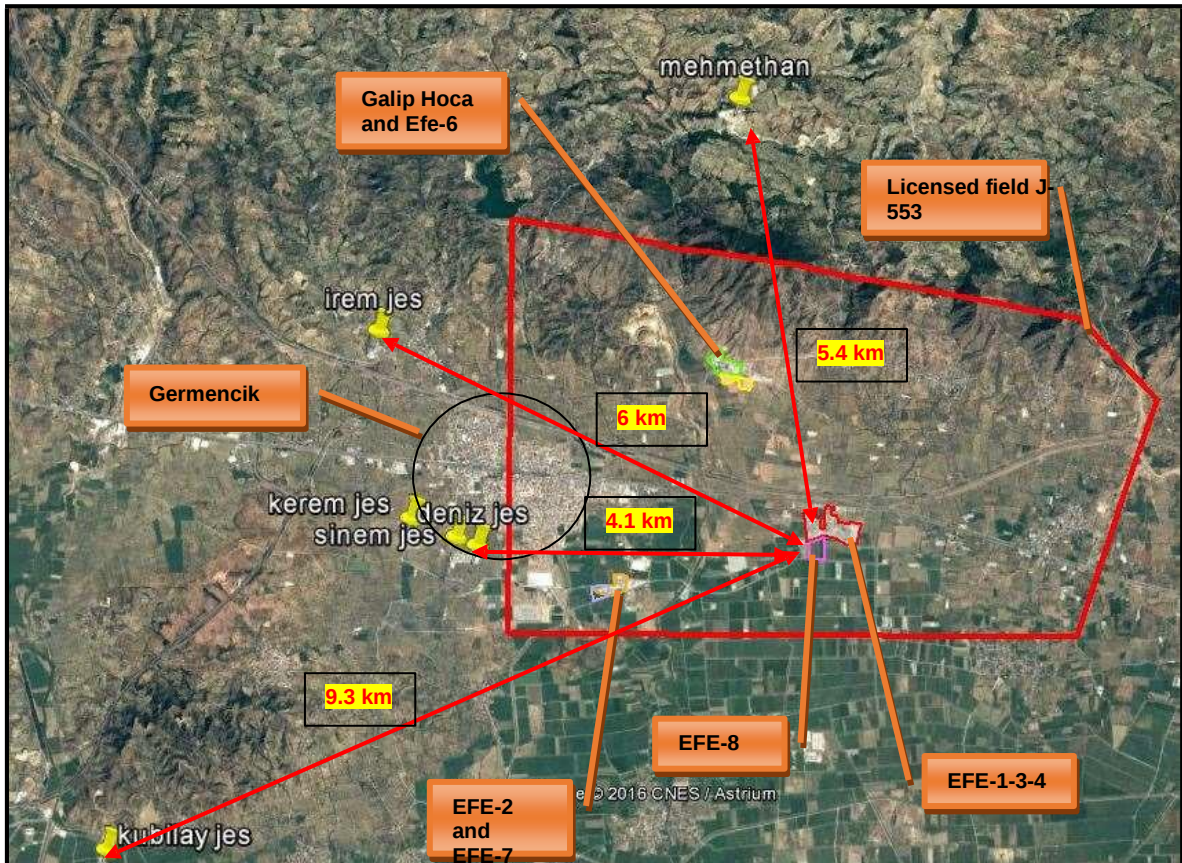


Figure 108 Geothermal plants within the Germencik region

According to MTA-2005 data ,geothermal fields in the district of Germencik are given as the point below.

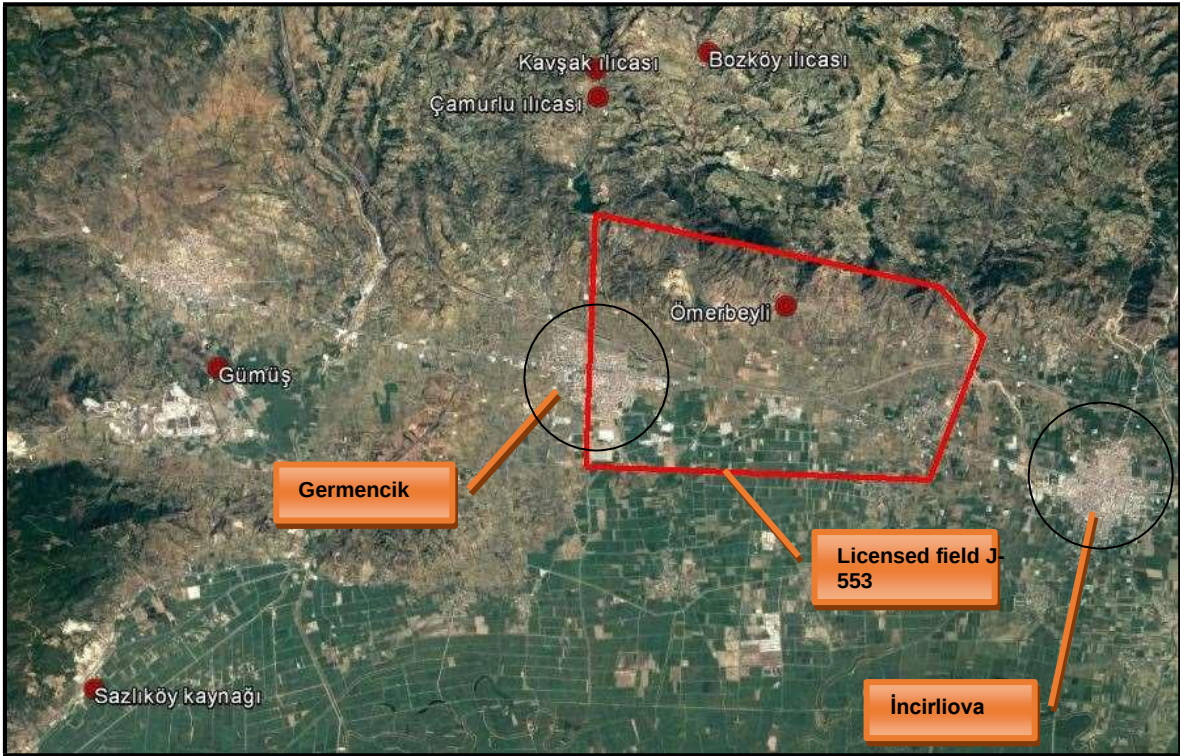


Figure 109 Geothermal sources within Germencik district

Source: Inventory of Geothermal Sources, 2005. MTA publication

A study with the title "Consultancy report on assessment of geological-hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations" has been completed by Prof. Dr. Şakir Şimşek in the licensed field.

In this context, the following studies have been evaluated: the locations of production/reinjection wells to be drilled in order to develop the Germencik geothermal operating licensed field and to utilize the field in a sustainable manner, identification of the geological and hydrogeological characteristics of the wells, and detailed assessment of hydrogeology and potential of the wells.

The mentioned report covers the following assessments on geological, hydrogeological, hydro-geochemical, geophysical potential for developing the Germencik geothermal field.

1-Examining all the data in the field and evaluating the field in terms of geological, hydrogeological and hydro-geochemical aspects, preparation of maps, section and block diagrams,

2-Examining geophysical gravity, resistance, seismic, and the like measurements 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 information 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- Depths of wells

b- Lithological properties of the rock units to be cut,

- c- Thicknesses of the units
- d- Fracture and fault zones to be used for production,
- e- Identification of reservoir zones suitable for possible mud leakage and production,
- 7-Determination of starting and ending coordinates and possible deviation points and slope degrees for directional drillings,
- 8-Investigation of the relationship between the licensed field 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. It is observed that Reservoir I in the Germencik field is wider and more exploitable than Reservoir II in terms of efficiency and temperature for electricity generation. 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 Reservoir II, considered widely and economically suitable for electricity generation, temperatures between 216 -239.51 °C were measured. More secondary porosity and permeability was developed compared to Reservoir I, and efficiency of production wells on this reservoir is higher.

Cap rock: In the wells drilled in the study area, 2 cap rock groups were determined which separated the reservoirs and had impermeable properties.

ICap rock I: 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 permeability is 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. The thickness of the Ömerbeyli Fault varies between 100 and 1400 m and further increases to the south. This is seen in the fence diagram.

II Cap rock II: Miocene base, allochthonous gneiss and schist levels belonging to the foundation form the second cap rock. Its thickness varies between 300 and 500 m. Considering cap rocks I and II together by neglecting the first reservoir, the thickness calculated varies between 730 and 1279 m from the northernmost well to the south.

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. However, it should not be limited to this field. Because, graben faults mainly extending E-W are intersecting with interconnected N-S strike faults, and it is obvious that feeding can be provided from very far areas as well by means of these faults. The main source of feeding for geothermal reservoirs is the total of the meteoric waters falling to the basin and underground and surface waters coming to the basin. The feeding of the reservoirs within the study area is closely related with the permeability of the lithologies in horsts and grabens.

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.

It was calculated that the granitic magma approach (heat source), which provides high local geothermal gradient in the field, is at a depth of about 9 km and 900 °C.

In line with the consultancy report prepared, the geothermal potential of the region is given in the following figure.

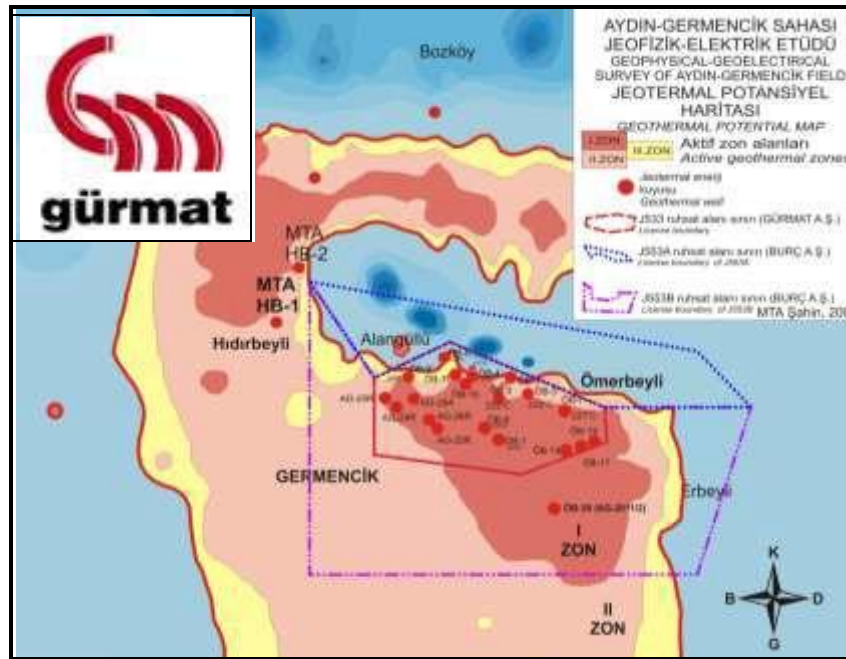


Figure 110 Geothermal potential map of the project site and its vicinity

Source: Consultancy report on assessment of geological- hydrogeological- geophysical potential of Aydın-Germencik geothermal operating license fields and determination of production/ reinjection well locations, Prof. 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"

The Cumulative H₂S modeling of facilities owned by the investor company in the J-553 licensed field under the project are given in the heading "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".

The gas to be discharged from cooling tower to the atmosphere at the operation phase of the project is the pollutant hydrogen sulfur (H_2S), the limits of which are stipulated in Table 2.2 of the Regulation on Industrial Air Pollution Control. A model for assessing the cumulative impact has been done for the concurrent operation of Efe 1-2-3-4 which are currently being operated, Galiphoca GPP, Efe-6 which is currently under construction, and the intended Efe-7 and Efe-8 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 RIAPC 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 licensed field 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 H_2S treatment efficiency is higher with the developing technologies.

It is extremely important to keep the gas emissions to be originated from the geothermal power plants in Germencik district within the limits stipulated in the Regulation on Industrial Air Pollution Control. Air quality and noise measurements are being carried out by the investing company, Gürmat Elektrik Üretim A.Ş., to determine the current situation. Measurements and analysis of samples taken within the J-553 licensed field 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 so as to store the geothermal fluid until the problem is eliminated. After the problem is resolved, the water collected in the pool will be transmitted into the reinjection system without being discharged again to the receiving environment. Thanks to the technology to be used and the measures to be taken, the physical structure of the soil shall be prevented from being affected as a result of the use of the geothermal source.

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 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 mating surfaces as well as operational 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 while cleaning the wells or reactivating 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 running water required for personnel to be employed and the irrigation water of roads used by periodic vehicles in the operational period of the intended project.

There will be wastewater generation from the personnel to be employed in the operation period of the project. Domestic wastewater, which will emerge during the operation phases of the project, will be collected in a septic tank and will be disposed of with a specific sewage truck. Aydın Metropolitan Municipality's letter promising to receive domestic wastewater by a sewage truck is presented in Annex-23.

Potable water required by the personnel will be provided through carboys within the scope of the project. As for the running water within the scope of the project, the provisions of the "Regulation on Water for Human Consumption" promulgated in the Official Gazette issue no. 25730 dated 17.02.2005 (Amended: OG-31.7.2009-27305, OG-7.3.2013-28580, OG-11.4.2014-28969) shall be complied with.

A letter from Aydın Metropolitan Municipality stating that utility water will be supplied is given in Annex-24.

The geothermal fluid to be produced at a rate about 2,500 tons/hour by 9 production wells within the scope of the project will be used by Efe-8 Geothermal Power Plant. Then, 99% of the fluid used will be reinjected through 8 reinjection wells.

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 promulgated in the Official Gazette issue no. 25687 dated 31.12.2004 shall be complied with for the disposal of liquid wastes to be generated 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 will be generated by the personnel to be employed during the operation phase of the project. During the construction phase of the project, assuming that 12 people will be employed and 1.16 kg solid waste will be generated a day per person ³⁰, the following amount of solid waste has been calculated.

$$\begin{aligned}\text{Amount of domestic solid waste to be generated} &= 12 \text{ persons} \times 1.16 \text{ kg/day-person} \\ &= 13,92 \text{ kg/day.}\end{aligned}$$

Domestic solid wastes generated by the personnel during the operation phase of the activity shall be collected in separate containers based on their characteristics (organic, glass, plastic, paper, metal, etc.) and kept in sealed containers within the project site without polluting the environment in terms of appearance, dust, odor, etc. 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" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with while collecting, storing, and transporting domestic solid wastes.

Packaging waste

Recoverable wastes generated during the operation phase of the project shall be collected separately from all other solid wastes and delivered at certain intervals to a contracted company having a license for collecting packaging wastes pursuant to the "Regulation on Control of Packaging Waste" promulgated in the Official Gazette no. 28035 dated 24.08.2011 and all amendments to that regulation.

The provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" promulgated in Official Gazette issue number 27605 dated 08.06.2010 (Amended: OG-14.6.2012-28323, OG-11.7.2013-28704) shall be complied with during the work.

³⁰ Source: TÜİK, www.tuik.gov.tr., 2014.

Formation of waste oil and hazardous waste

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 of within the framework of the relevant regulations.

The provisions of the "Regulation Waste Oil Control" promulgated in the Official Gazette no. 26952 dated 30.07.2008 (Amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812) shall be complied with during all the works to be done within the project site.

All maintenance and repair procedures in the project site shall be carried out in a sealed area, and the provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" promulgated in Official Gazette issue number 27605 dated 08.06.2010 (Amended: OG-14.6.2012-28323, OG-11.7.2013-28704) shall be complied with during the work.

The provisions of the "Waste Management Regulation" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with for any hazardous wastes occurring in any stage of the project.

In addition, the provisions of the "Waste Management Regulation" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with for any hazardous wastes occurring in any stage 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 authorized service stations outside the activity area, battery replacements will also take place outside the plant. Each accumulator will be delivered to the service station from which the new accumulator is purchased.

However, in the event of any battery replacements in the plant in case of an emergency, waste accumulators shall be stored temporarily in a sealed indoor setting within the project site, and it shall be ensured that they are disposed of by being delivered to a recovery/recycling company licensed by the Ministry of Environment and Urbanization pursuant to the provisions of the "Regulation on Control of Waste Batteries and Accumulators" (Amended: O.G. - 03.03.2005/25744, O.G. - 30.03.2010/27537, O.G. - 5.11.2013-28812, O.G. - 23.12.2014- 29214) promulgated in the Official Gazette issue no 25569 dated 31.08.2004.

The provisions of the "Regulation on Waste Landfill" (Amended: O.G. 11.03.2015 – 29292) entered into effect on 01.04.2010 and promulgated in the Official Gazette issue no. 27533 dated 26.03.2010 and the "Regulation on Control of Waste Batteries and Accumulators" (and all the amendments to the regulation) promulgated in the Official Gazette issue no. 25569 dated 31.08.2004 shall be complied with during the construction phase of the intended activity.

End-of-life tires

Tires likely to result from the vehicles to be operated during the operation phase of the activity shall be disposed of by being stored temporarily in an enclosed and sealed place within the project site and delivered to a company licensed by the Ministry of Environment and Urbanization pursuant to the provisions of the "Regulation On Control Of End-Of-Life Tires" promulgated in the Official Gazette issue no. 26357 dated 25.11.2006 (Amended: OG-30.03.2010-27537, OG-10.11.2013-28817, OG-11.3.2015-29292).

Medical waste

Medical equipment capable for performing immediate treatment in case employees, who will work in the operation 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 healthcare facilities located in the nearest settlements. Although the amount of wastes to be occurred in the plant in this context 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 colored plastic bags which are resistant to puncturing, tearing, exploding; made of original medium-density polyethylene, leak-free, with double bottom seam, with sufficient capacity to carry at least 10 kg and with double layer thickness of 100 micron, without bellows, with "International Biohazard" emblem and "ATTENTION! MEDICAL WASTE" phrase. Bags shall be filled maximum to $\frac{3}{4}$ level, and their openings shall be tightly tied; and in case deemed required, each bag shall put into another bag with the same specifications to ensure sealing. The contents of medical waste bags will never be compressed; medical wastes will not be removed from the bag, or unloaded or transferred to another container.

Wastes with cutting-puncturing features shall be separated from other wastes and placed in plastic or laminated cardboard boxes which are resistant to puncturing, tearing, cracking, exploding, and are water-resistant and leak free, impossible to open and touch the contents, with "International Biohazard" emblem and "ATTENTION! SHARP MEDICAL WASTE" phrase, 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 never be compressed, opened or emptied.

The provisions of the "Regulation on Control of Medical Waste" promulgated by the Official Gazette issue no 29959 dated 25.01.2017 shall be complied with throughout the entire 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. The heating and insulation effect of the atmosphere created in this way 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.

During the operation phase of the project, emissions from the cooling tower are expected.

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. The content of the noncondensable gases during the operation phase of the Geothermal Power Plant can be listed as follows: CO₂, N₂, CH₄, NH₃, H₂S, O₂, and H₂. Approximately 99% of the volume is CO₂, whereas other gases are present in trace amounts.

As is known, developments in technology and industry and growth in population exposed the earth to a tremendous 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.

Carbon dioxide emission data for the geothermal power plant, which is the subject of the project, and energy generation types are given in Table 73.

Table 73. Types of power generation and CO₂ emissions

Plant type	Lowest gCO ₂ eq/kWhe	Average gCO ₂ eq/kWhe	Highest gCO ₂ eq/kWhe
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/kWhe: 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.

Evaluating the GPP project in terms of determining greenhouse gas emissions; the project is not included in Annex-1 List of the "Regulation on Monitoring Greenhouse Gas Emissions" promulgated in the Official Gazette issue no. 29003 dated May 17, 2014.

Air quality and noise measurements are being carried out by the investing company to determine the current situation. Measurements and analysis of samples taken within the J-553 licensed field were carried out by accredited authorized laboratories.

The following amendments to the "Regulation on Industrial Air Pollution Control" (RIAPC) promulgated in Official Gazette issue no. 27277 dated 03.07.2009 shall be complied with during every stage of the project: 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

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 causing noise will be regularly maintained and renewed after their economic life is over. In addition, it shall be ensured that personal protective equipment (headphones, etc.) are used by the employees working in the facility, noise measurements shall be made periodically.

Equipments such as pumps, generators, etc. to be used within the scope of the project shall be indoors, so they shall not lead to noise affecting the project site and its vicinity adversely.

In parallel with the technological developments of today, the noise to be generated in the facility is expected to be much lower than the calculated levels. Moreover, maintenance and controls will be carried out periodically to reduce the noise level. 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. The "Regulation on Assessment and Management of Ambient Noise" promulgated in the Official Gazette issue no. 27601 dated 04.06.2010 (Amended: OG-27.4.2011-27917) shall be complied with in every stage of the activity.

Reviewing the "Environmental Permit and License Regulation" promulgated in the Official Gazette issue no 29115 dated 10.09.2014 (Amended OG no 29117 dated 12.09.2014), it is observed that the Geothermal Power Plant is not included in the Lists of Annex-1 and Annex-2 of the regulation. Therefore, an application shall be lodged with Aydın Provincial Directorate of Environment and Urbanization for an opinion of exemption from noise permit.

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 site is not located within the forest area.

It is 1.5 km from the nearest forest area to the project site. Necessary measures against possible negative impacts on forest areas are listed below:

- The personnel to be employed within the scope of the project will be trained on the subject of fire.
- It will be acted in accordance with the Fire and Emergency Plan against possible forest fires.
- The staff will be prevented from setting fire in the field and leaving flammable substances in the field.
- In the event of a potential fire, the nearest forest authority or police will be notified.
- Fire extinguishing instruments and equipment shall be deployed to necessary spots to be used in case of a potential fire.
- Excavation and dumping operations shall not be performed on forested areas.
- 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 a sprinkler. 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-8 Geothermal Power Plant project; a report named "Determination of the impacts of the geothermal power plant project on vegetative and generative development of olive trees around the project site" prepared by Associate Professor Doctor Mücahit Taha Özkaya from Ankara University, Faculty of Agriculture is presented in Annex-25.

This report says "as a result, it is observed that there is no harm in olive trees fig trees due to geothermal fluids arising from the existing power plants and the geothermal drilling wells. It is concluded that the production stages of future geothermal power plants in the region will have a similar result for the fig and olive trees and will not cause any harm".

Underground and surface water resources and soil shall be prevented from polluted by disposing of the solid and liquid wastes that will occur during the operation within the regulatory framework.

The geothermal fluid used in the operational phase of the intended 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, an emergency pool will be used. The geothermal fluid will be stored until the system is reactivated and it will be transferred to the reservoir through 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.

No harmful substances shall be discharged to the receiving environment and no water pollution shall be caused during construction and operation pursuant to article 20 of Fisheries Law no. 1380 and articles 11 and 12 of the Fisheries Regulation.

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.

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.

In order to use agricultural lands under the project for non-agricultural purposes, necessary permits shall be obtained from Aydın Provincial Directorate of Food, Agriculture and Livestock and/or the Ministry of Food, Agriculture and Livestock pursuant to the Soil Conservation and Land Use Law no. 5403 promulgated in the Official Gazette issue no. 25880 dated 19.07.2005.

III.2.18. Measures to be taken for flora/fauna

The fact that the project site is in an 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.

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 Species of Wild Plants and Animals) shall be complied with.

III.2.19. Determination of potential impacts on underground and aboveground cultural and natural assets, and measures to be taken

No flammable or explosive substances will be used during the construction phase of the intended project. Construction equipment will be used for the work to be done.

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

Furthermore, in the opinion no. 4922 of the Directorate of Conservation of Regional Cultural Assets dated 22.12.2016 given in Annex-14, it is stated that there is no registered protected area or structure in the Efe-8 Geothermal Power Plant project (2*25=50Mwe) in terms of cultural assets regarding the Law No. 2863 on Protection of Cultural and Natural Property.

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.

The project site is included in the scope of the Law no 2863 on 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 intended project is planned to employ 400 people during the land preparation and construction phase, and approximately 12 people during the operation phase, and personnel needs will be provided primarily from the settlements in the vicinity of the project site.

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 site, 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. Aydın Metropolitan Municipality's letter promising to receive domestic wastewater by a sewage truck is presented in Annex-23.

Domestic solid wastes generated by personnel within the scope of the project shall be collected 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-8 Geothermal Power Plant 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 personnel to be working during the operation phase are trained and have a certificate of competence. In addition, the working hours of the personnel 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 shall be taken in the facility area and guards shall be kept available at all times.

There shall 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 stipulated 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 available in the facility. In case of more severe injuries and accidents, the person will be immediately sent to the healthcare facilities located in the nearest settlement.

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 in case of noise and gas emissions, failure to dispose of solid and liquid wastes, lack of necessary precautions.

In order to prevent all possible risks to human health at all stages of the project, all the health and safety rules stipulated by regulations and the Occupational Health and Safety Law No. 6331 shall 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 Quality³¹**

As a result of urbanization brought by modern life, air pollution has a global sphere of influence in addition to its 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).

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).

³¹ Environment status report 2015 for Aydın Province



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.) depending on meteorological events.

Sulfur dioxide (SO_2), a colorless gas, is oxidized as sulfate and sulfuric acid after reaching the atmosphere. Together with other contaminants, it creates droplets or solid particles that can be carried over large distances. SO_2 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 (NO_2) form the total nitrogen oxides (NOX). Nitrogen oxides are usually given out as NO (in 90% of the cases). It occurs as a result of the reaction of NO or NO_2 with ozone or radicals (such as OH or HO_2). NO_2 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 NO_2 concentrations for a short time can lead to severe lung damages. For the individuals having chronic lung diseases, the exposure to this concentrations can cause dysfunctions in the lungs in the short term. In case of prolonged exposure to NO_2 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 resources. 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) Efforts on legislative regulations to cover particles up to 2.5 µm are under process. The biggest natural source of PM₁₀ is dust from the roads. Other important sources are traffic, coal and mine quarries, construction areas and quarries. In terms of health effects, 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 there, 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 being 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 pollution.

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 odorless 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), propane (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 is a large risk group. 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 our province 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 Industrial Air Pollution Control 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 PM(10) 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 PM(10) 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.

In addition, noise complaints sent to the Provincial Directorate of Environment and Urbanization 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 amusement enthusiasts who are insensitive to the environment and do not respect other people, because local government fail to take adequate technical and administrative measures in development plans to reduce the noise.

Furthermore, outdoor places of amusement, the number of which have increased recent years, sometimes stay active until the early hours of mornings in contradiction with the standards stipulated in the Regulation on Assessment and Management of Ambient Noise and create a great discomfort with their electronically-amplified music for the nearby houses and recreational facilities. High electronic sounds can be extended to much longer distances during nights when transportation noise and other background noise are minimized.

The Regulation on Assessment and Management of Ambient Noise promulgated in the Official Gazette issue no. 27601 dated 04.06.2010 have been amended by the regulation promulgated in the Official Gazette issue no 27917 dated 27.04.2011. With the amendment to the Regulation “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 Environment status report 2013 for Aydın Province

With the amendment to the Regulation, 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. Ambient 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. Ambient noise caused by a place of amusement not adjacent to a building affected by ambient noise arising from that place of amusement should not exceed the background noise more than 5 dBA and 7 dBC in terms of Leq noise indicator. The total noise level emitted from multiple places of amusement should not exceed the background noise more than the range of 7-10 dBA in terms of Leq noise indicator. It is forbidden to broadcast live music between 24:00-07:00 at open and semi-open places of amusement in areas of sensitive use.

Moreover, concerts, shows, meetings, ceremonies, festivals, weddings, and similar outdoor activities nearby, adjacent to, under or over areas of very sensitive use are also forbidden by this regulation. The level of noise emitted from such activities in areas of sensitive use and less sensitive use cannot exceed the background noise more than 5 dBA in terms of Leq noise indicator.

Water pollution³³

The reasons for the pollution in Büyük Menderes River are listed below:

Dokuzsele Creek (Uşak), Banaz Brook (Uşak), Çürüksu Brook (Denizli), Büyük Menderes Plain (Aydın), and Lake Bafa (Aydın) are hot points where pollution is intense. Comparing point-source pollution loads arising from urban areas, industrial facilities, and landfills within the basin with non-point source pollution, point-source pollution has a smaller share in total pollution. Textile and leather industry, which is a source of industrial pollution, is concentrated in Denizli and Uşak. The most serious problems in terms of water quality in Büyük Menderes River reaching Aydın province with the effect of the pollution sources in the upper basin and entering into the boundaries of Buharkent district according to monitoring activities carries out by the 21st Regional Directorate of DSİ are as follows:

- Excessive organic matter, nitrogen, pH, heavy metal pollution and oxygen deficiency in Gökpınar Brook arising from Denizli;
- Organic matter and salinity leading to nitrogen pollution along the Denizli-Sarayköy-Kuyucak line in Çürüksu Brook and Büyük Menderes River, and
- Excessive organic matter and nitrogen pollution, salinity, and oxygen deficiency caused by Uşak in Dokuzsele Creek (before Banaz Brook).

³³ Environment status report 2015 for Aydın Province

The river enters into the boundaries of Aydın province with water quality 3rd class in terms of inorganic pollutants and 4th class in terms of organic pollutants (very dirty, cannot be used for water supply or agricultural irrigation purposes). The river gets better on the basis of inorganic and organic parameters and rises to Class II water quality starting from Kuyucak district. (It is observed that the pollution load is diluted because of the side creeks and brooks connected to the river.) However, it maintains its Class IV characteristic in terms of the sulfate parameter. There are many creeks and brooks joining Büyük Menderes within the boundaries of Aydın province. These are Feslek, Kestel, Malgaç, Köşk, Musluca, İmamköy, Tabakhane, Karagöz, Yalkı, İkizdere, Alangüllü, Kocadere, Dalama, Çakırbeyli, Çakmar, Koçarlı, and Sarıçay creeks joining from right hand side and Çine, Akçay, and Dandalaz brooks. Classifying the pollution in Büyük Menderes within the boundaries of Aydın province,

- Pollution arising from industrial facilities:

Leather, textile, cotton weaving, yarn and ceramic industries in Uşak province discharge wastewater to Dokuzsele Brook which is feeding Adıgüzel Dam and a branch of Banaz Brook.

Similarly, wastewater arising from many textile-intensive workplaces in Denizli province is also discharged to Büyük Menderes River through Çürüksu Brook and other branches of Büyük Menderes River. There are many industrial facilities in Denizli. However, it is necessary to constantly check whether these treatment plants are operated in accordance with appropriate standards. Furthermore, almost all of these treatments have been constructed according to the discharge criteria determined according to sectors. Since the waters of Çürüksu Brook and Büyük Menderes River, to which wastewaters are discharged, are used for irrigation, minimum discharge criteria for irrigation water must be fulfilled. Therefore, these wastewater treatment plants need to be renewed in order to meet the minimum irrigation water discharge criteria. Although Menderes Textile Factory, which is also located near Sarayköy, has a treatment plant, it should be checked periodically whether this treatment plant is operated on a continuous basis. Because, wastewaters of this factory is discharged directly to Büyük Menderes.

Other small industrial facilities operating in the provinces within the basin do not have treatment plants or their plants are not operated efficiently. The situation of industrial facilities affecting the pollution in Büyük Menderes River within the boundaries of Aydın province is summarized below.

In Aydın province, especially in years with olive crops, the red water stemming from olive oil factories is also a factor of pollution. Wastewaters arising from olive processing in approximately 154 olive oil factories in Aydın province contain Boron mineral with average density 5.19 ppm and have a high Chemical Oxygen Demand (COD). Although these enterprises operate seasonally, the pollution they have created in the region is not negligible because there are too much enterprises, the amount of wastewater they create is high, the chemical content of the red water creates, and the lack of treatment technology in these facilities. A common treatment plant cannot be built for the olive oil factories because they are distributed to almost all districts; furthermore, the fact that these factories are small-scale, the high cost of treating olive red water, and impossibility of complete treatment with the existing technologies makes it difficult to build treatment plants.

For the wastewater disposal of olive oil factories in Aydın province to solve the olive red water problem, in line with letter 10691 of opinion dated 12.07.2002 from the General Directorate of EPSP of the abrogated Ministry of Environment, pursuant to resolutions 15 and 21 dated 29.03.1996 and 09.04.1997, respectively by Aydın Local Environmental Board, the decision of disposing all wastewaters (red water) that can be created in a season by a method of collecting and evaporating such wastewaters in outdoor impermeable evaporation lagoons (pools) with a maximum depth of 1 m constructed properly and not discharging wastewaters to the receiving environment by no means apart from this is being applied.

One of the main sources of water pollution in Aydın province is olive oil processing facilities. The waste black water (red water) which emerged as a 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 approximately 154 olive oil factories spread all over the province. Since the General Directorate of Environmental Management of the abrogated Ministry of Environment and Forestry stated that the wastewaters (black water) of olive oil factories should be accumulated temporarily in impermeable evaporation lagoons (pools) to be constructed with a sufficient capacity for all wastewaters that can be created in at least one season and then evaporated or disposed of by one of the other methods specified in the letter (transition to a 2-phase system, joint treatment methods, etc.) and that such wastewater should never be discharged to the receiving environment, the Provincial Directorate is acting accordingly. If olive black water arising from olive oil factories is to be disposed of by means of evaporation, impermeability should be provided (covering with reinforced concrete, PVC or membrane, laying a clay layer, etc.) and its impact on the groundwater, capacity qualifications and the rainfall amounts depending on seasonal conditions must also be taken into account. On the other hand, the high number of such factories and the fact that they are dispersed make it difficult to audit them; and there are difficulties in the applicability of this method due to reasons such as the fact that they cannot build lagoons of sufficient size or such lagoons are filled with rainfall.

There are 6 Organized Industrial Zones (OIZ), already or being constructed, in total within Aydın province having industrial pollution elements.

A contract for a project design of a new WWTP has been signed in addition to the existing industrial WWTP of 2500 m³/day which has become insufficient as a result of the increase in water use and changes in wastewater character in Aydın OIZ operating in Umurlu Town, whereas the process related to the public interest decision regarding the area of the plant is ongoing.

Currently, some of OIZ wastewater is treated and some of it is discharged directly into Musluca brook. In Umurlu Industrial Zone, there is a waste water treatment plant which is inadequate in terms of quantity and quality, and it is still in operation to reduce the pollution load of wastewater. Wastewaters arising from the OIZ reach Büyük Menderes River through Musluca Brook.

An industrial- (physical+biological+chemical) type WWTP with 1700 m³/day capacity belonging to ASTİM OIZ was completed and commissioned in December 2011. An application for temporary operation certificate related to discharging the wastewaters of the plant to the receiving environment has been made, and the process is ongoing.

The construction of industrial- (physical+biological+chemical) type WWTP with 2000 m³/day capacity belonging to Ortaklar OIZ is continuing.

Wastewaters generated by Nazilli OIZ being currently established are delivered to the WWTP belonging to Nazilli Municipality in accordance with the protocol between Nazilli Municipality and OIZ administration and with the resolution of the municipal council.

Expropriation and infrastructure investments in Çine and Söke organized 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

Wastewaters are discharged to Büyük Menderes River directly or indirectly along 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 pesticides used in irrigated agriculture

Chemical fertilizers and pesticides used within irrigated agricultural areas contaminate surface waters and penetrate groundwater. And, some of these groundwater contaminated with these wastes are discharged to surface waters by means drainage, and reduce their quality consequently. Similarly, it is possible that these waters mix up with groundwater and cause pollution.

Impacts of the intended project on the existing pollution load

Determination of pollution load in terms air

The project site is located near a highway and some facilities. Sources that may affect the project site and its immediate vicinity in terms of air pollution are emissions from domestic heating and transportation in the region. However, due to the fact that the project site is in the Aegean region and winters are not too harsh, it is difficult to talk about emissions caused by domestic heating. Various-size vehicles pass through the nearest part of the İzmir-Aydın highway, and it appears that emissions from the highway are significant pollutants for agricultural products especially on the 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 assumed to be used, pollution from domestic heating is negligible.

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. The content of the noncondensable gases during the operation phase of the Geothermal Power Plant can be listed as follows: CO₂, N₂, CH₄, NH₃, H₂S, O₂, and H₂. Approximately 99% of the volume is CO₂, whereas other gases are present in trace amounts.

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 emissions are less than those used in coal and natural gas plants.

During the operation phase and throughout the activity period the provisions of the legislation shall be strictly observed, and emission measurements shall be got done by competent bodies and submitted to the relevant authority, if required and/or necessary.

In the context of the intended project, all measures related to emissions will be taken during the construction and operation phases.

The following amendments to the "Regulation on Industrial Air Pollution Control" (RIAPC) promulgated in Official Gazette issue no. 27277 dated 03.07.2009 shall be complied with during every stage of the project:

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

Cumulative H₂S modeling within the scope of the project

During the operation phase of the plant, greenhouse gases such as non-condensing carbon dioxide and methane shall be released from the geothermal source. Geothermal fluids include heavy metals and chemicals, as well as non-condensing gases in varying amounts depending on the reservoir conditions. Since the gases in question exist under a certain pressure in the reservoir, they are dissolved in the geothermal fluid. The content of non-condensed gases released the pressure and temperature loss of the geothermal fluid while transforming the pressure and temperature of the fluid into electrical energy during the operation phase of the power plant is as follows: CO₂, N₂, CH₄, H₂S, H₂, O₂, Ar, C₂H₆, and C₃H₈, whereas CO₂ at about 99% by volume has an important place compared to other gasses that are at trace amounts.

The intended 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 licensed field. The amounts of geothermal fluid used by the plants within the project site and its sphere of influence as well as the amounts of non-condensed gases in these amount are given in Table 74.³⁴ Mass flow rates must be calculated in order to compare these emissions with the limits stipulated in the "Regulation on Industrial Air Pollution Control". The average Mol percentage of the gases in the geothermal fluid is calculated and presented in Table 75.

Table 74. Geothermal fluid use of power plants and non-condensing gas quantities in these uses

FACILITIES	Flow rate of fluid used (tons/hour)	Amount of non-condensing gases (tons/hour)
Efe 1	2,250	29.7
Efe 2	1,100	14.52
Efe 3	1,100	14.52
Efe 4	1,100	14.52
Efe 6	1,400	18.48
Efe 7	1,500	19.8
Efe 8	2,500	33
Galiphoca	2,250	29.7

Table 75. 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, gas emissions expected from cooling towers are calculated as follows.

³⁴ As a result of the analysis and evaluation, approximately 1.32% of the geothermal source is composed of non-condensing gases.

Weight of 1 mole gas;

$0.9927500 \times 44 \text{ g/mol (CO}_2\text{)} + 0.003759 \times 28 \text{ g/mol (N}_2\text{)} + 0.00286 \times 16 \text{ g/mol (CH}_4\text{)} + 0.000449 \times 34 \text{ g/mol (H}_2\text{S)} + 0.000058 \times 2 \text{ g/mol (H}_2\text{)} + 0.000042 \times 32 \text{ g/mol (O}_2\text{)} + 0.00003 \times 39.9 \text{ g/mol (Ar)} + 0.000026 \times 30 \text{ g/mol (H}_2\text{)} + 0.000006 \times 44 \text{ g/mol (H}_2\text{)} = \sim 43.85 \text{ g/mol}$

Thus, the emission amounts for H₂S are calculated as follows:

$\text{H}_2\text{S} = \text{Non-Condensed Gas Amount} \times 8,760 \text{ sa/year} \times 0.000449 \times 34 \text{ g/mol} / 43.85 \text{ g/mol}$. Accordingly, the H₂S emission amount of each facility is given Table 76.

Table 76. H₂S emissions of each plant

FACILITIES	Emission amount (tons/year)
Efe 1	90.58
Efe 2	44.28
Efe 3	44.28
Efe 4	44.28
Efe 6	56.36
Efe 7	60.38
Efe 8	100.64
Galiphoca	90.58

Calculation of contribution to air pollution

AERMOD (AMS/EPA Regulatory Model Improvement Committee Model) developed by EPA and approved by the same organization for use in EIA studies in the USA has been used as an air distribution modeling. The AERMOD model is internationally recognizes, and is used by many researchers and inspection and authorized bodies around the world to estimate polluting concentrations. 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 were determined and these values were compared with the short- and long- term limits in the RIAPC. As a result of these comparisons, effects of dust emissions on air quality in the region were determined.

The results of the model were compared to the H₂S values given for year 2024 in Table 2.2 of Annex-2 of the "Regulation on Industrial Air Pollution Control" promulgated in the Official Gazette issue no 29211 dated 20.12.2014.

Three kinds of data set were employed to operate the AERMOD model. These are as follows:

- Topographic data (DEM file generated by the help of AERMAP)
- Meteorological data (profile and surface files generated by the help of AERMET)
- Emission data

Emission data employed in the modeling

The model was run considering the worst case scenario, as stated in Annex-2.4 in RIAPC, and taking into account that 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.

While running the model, data of the emission from cooling towers were used in the operation phase of the project.

Topographic data employed in the modeling

In the modeling process, 8 x 8 km zone was selected as a field of examination assuming that it is an area greater than a distance fifty times of the highest flue height considering the flues of the plant.

The data file of the modeling file was created by identifying 500-m reference points as specified in RIAPC for the area to be modeled by means of AERMAP software, which is the preliminary processor of the AERMOD model. 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 receiver position (grid point). Moreover, the distribution model provides data to continue distribution around the upgrades or to maintain the effects of the air flowing through the compartment.

In order to identify the units planned to be erected on the existing air quality in AERMOD by means of this DEM file by the help of AERMAP, a grid system was created within the study area and the edge lengths of squares in this system was taken 500 m. The corner points of the squares in the grid system were defined as receiving environments and topographic elevations at these points were determined by the help of the DEM file. The study area was digitized by this method and used as model input.

Meteorological data employed in the modeling

Meteorology is the most important factor affecting atmospheric distribution of pollutants. Data obtained from the Turkish State Meteorological Service was used for the provision of meteorological information required for the 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 Weather 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.

The gas to be released to the atmosphere from the cooling tower during the operation phase of the project is hydrogen sulfur (H_2S), the limits of which are stipulated in Table 2.2 of the Regulation on Industrial Air Pollution Control; whereas a model for assessing the cumulative impact has been done for the concurrent operation of Efe 1-2-3-4 which are currently being operated, Galiphoca GPP, Efe-6 which is currently under construction, and the intended Efe-7 and Efe-8 projects. Physical information about cooling flues, which are the emission sources of plants, is given in Table 77.

Table 77. Physical information about plant flues

FACILITIES	Cooling system	Quantity	Height (m)	Diameter (m)	Flue gas rate (m/sec)
Efe 1	Water-cooled	8	15.85	9.144	7.20
Efe 2	Air-cooled	84	12	4.910	3.52
Efe 3	Air-cooled	84	12	4.910	3.52
Efe 4	Air-cooled	84	12	4.910	3.52
Efe 6	Air-cooled	52	12	8.250	4.48
Efe 7	Air-cooled	52	12	8.250	4.80
Efe 8	Air-cooled	104	12	8.250	8.00
Galiphoca	Water-cooled	8	15.85	9.144	7.20

Limit values for hydrogen sulfide gas and cumulative data obtained from all plants operating simultaneously in the region (Efe 1-2-3-4-6-7-8, Galiphoca) are given in the following table as a result of AEROD modeling.

Table 78. Limits for the maximum hourly level, short-term level and RIAPC obtained by modeling for H_2S emissions likely to occur during the operation phase

EMISSION	AVERAGE PERIOD	Hourly value	Short term value	RIAPC Table 2.2. LIMITS (STL and LTL) (2024)
H_2S	Hourly	0.00001	-	100 $\mu g/m^3$
	STL	-	0.000001	20 $\mu g/m^3$

As shown in Table 78, the maximum hourly value and STL values obtained by modeling for H_2S emissions that are likely to occur from all plants during the operation phase provide the limit values (hourly and STL) specified in RIAPC Table 2.2.

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 RIAPC limit values and therefore the activity will not pose any danger to human and environmental health. It is assumed for the modeling that all power plants are in operation and emission distribution is compatible with the existing technologies; whereas processes with higher H_2S treatment efficiency thanks to developing technologies are preferred and the amount of emissions is expected to decrease. The map showing the results of the modeling and distribution is presented in the following figures.

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.	0.00000c	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 Result of AERMOD Model

The distribution of the modeling within the licensed field is given in the following figure.

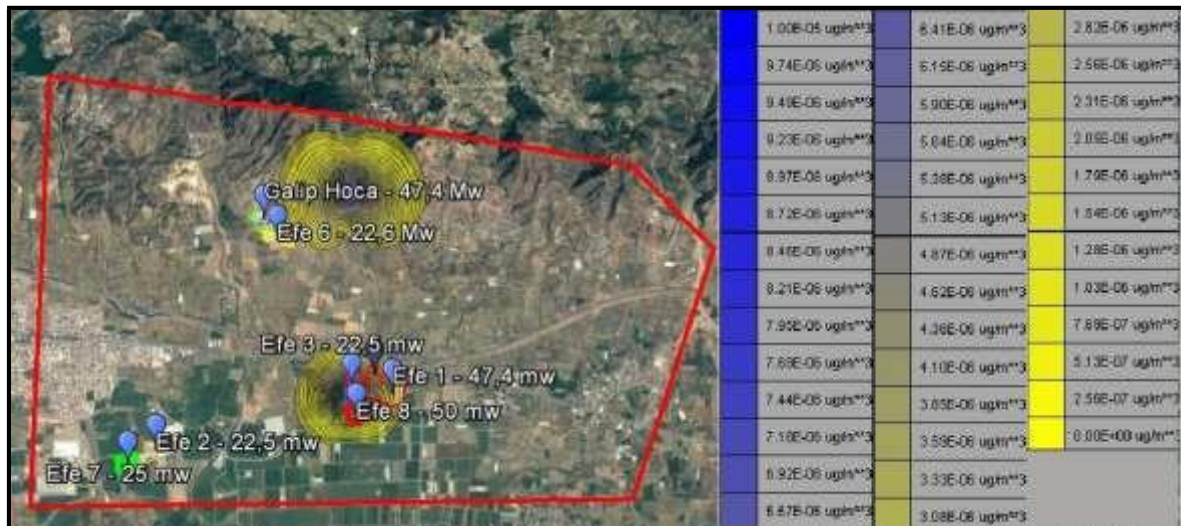


Figure 113 Cumulative modeling distribution within licensed field J-553

In AERMOD modeling studies, topographic data (DEM file created by the help of AERMAP) and meteorological data (Profile and Surface files created by the help of AERMAT) were used together with the emission data of plants.

According to 1960-2015 long-period number of blows of Aydın weather station, the primary dominant wind direction is east (E), the secondary dominant wind direction is east-southeast (ESE), and the tertiary dominant wind direction is west (W). The direction of the maximum wind observed is WSW (west-southwest), whereas its speed is 28 m/sec. The dominant wind direction, numbers of blow and other meteorological characteristics are given under the heading "II.2.1 Meteorological and climatic characteristics".

The hourly modeling distribution emerged in line with the data used in modeling is recorded on Figure 114 and Figure 115. The distribution data on these figures have been obtained by reflecting the numeric values emerged by calculation on the figures, and they indicate that concentration values are more intense.



Figure 114 Modeling distribution (south)

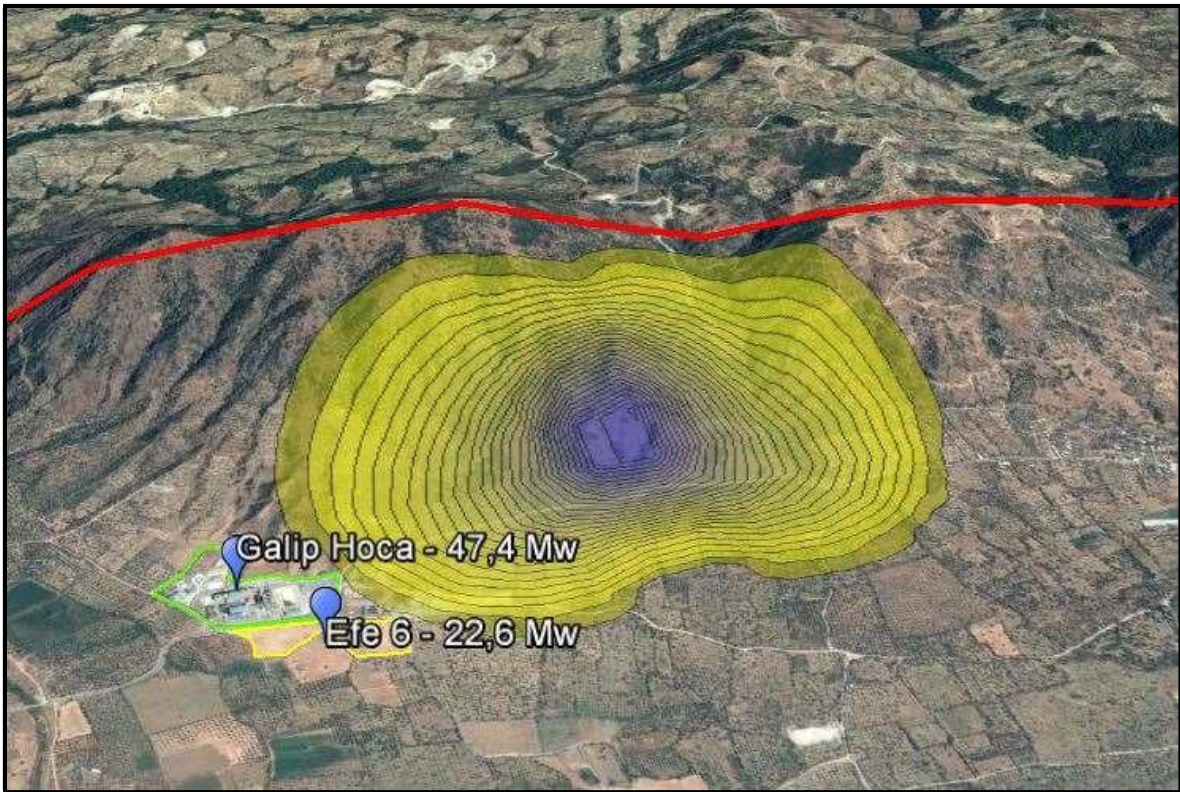


Figure 115 Modeling distribution (north)

Determination of pollution load in terms 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 groundwater depending on climate conditions, soil structure and time.

For groundwater, it is possible to say that nitrogen and phosphorus-weighted pollutants are more concentrated in general. This shows that groundwater 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 a drilling mud pool, the impermeability of which is provided by means of geomembrane, and they shall not affect the existing pollution load since they will not be discharged to any receiving environment.

Determination of pollution load in terms soil quality

The soil structure in and around the project site are productive and very favorable for agriculture. There will be no change in soil quality as was since electricity will be generated by means of a renewable energy source and no waste and/or discharge will be delivered to soil or streams without fulfilling the limits stipulated in the relevant regulations.

On the other hand; the relevant provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" promulgated in Official Gazette issue number 27605 dated 08.06.2010 shall be observed during the construction and operation phases.

Determination of pollution load in terms noise

Air quality and noise measurements are being 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 licensed field 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

During the operation and 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, the 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, if any type of fauna which is sensitive, vulnerable, and protected is identified within the project site, the relevant regulations will be followed; such species shall be protected in accordance with the measures of the Land Hunting Law and Regulation no. 4915 and international conventions (Bern and CES convention).

Within the scope of the planned Efe-8 Geothermal Power Plant project; a report named "Determination of the impacts of the geothermal power plant project on vegetative and generative development of olive trees around the project site" prepared by Associate Professor Doctor Mücahit Taha Özkaya from Ankara University, Faculty of Agriculture is presented in Annex-25.

This report says "as a result, it is observed that there is no harm in olive trees fig trees due to geothermal fluids arising from the existing power plants and the geothermal drilling wells. It is concluded that the production stages of future geothermal power plants in the region will have a similar result for the fig and olive trees and will not cause any harm".

The matters in said report under the heading of "the matters to be considered by enterprises with reference to olive production" will be complied with.

III.2.24. Other Characteristics

There is no other issue to be specified under this heading.

III.3. Impacts of the project 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

There is an increasing national energy demand in parallel with the growing industry and economy. It is obvious that any economical investment in the national generation capacity would serve the interests of the domestic investors and our people.

The national energy policy is to provide reliable, good quality and clean energy to all users at the right time in order to support healthy economic and social development. Therefore, it is expected that all domestic and imported energy resources are used and all domestic & foreign and public & private investment and finance facilities are use in order to supply energy needed to meet energy demands in an economical and reliable manner.

The electrical energy to be generated within the scope of the project will play a significance role meeting the increasing electricity demand of Turkey.

Considering the that the materials needed within the scope of the project will be provided from the facilities in the region and the fuel and mineral oil necessary for construction machines and vehicles to be used for construction and the technical, social, and daily needs of the personnel will ve supplied locally, it can be concluded that the project will enhance the local economic activity.

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 on the surrounding agricultural areas will be reduced.

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-8 geothermal power plant, total of 412 personnel are planned to be employed. A large part of the unskilled workers planned to be employed with the project will be recruited locally.

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-8 GPP will provide job opportunities for 400 in the construction phase and 12 people in the operation phase, and that the need for unskilled labor will be met locally, 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, migration

With the start of the construction phase of the project, the need for labor 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 400 people in the construction phase and approximately 12 people in the operation phase, and that part of this workforce will be selected from local people as unskilled workers, it is not expected to have a great impact on the existing structure.

No emigration 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 pretty 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.

A training project is planned to raise qualified personnel in agriculture, greenhouse and geothermal fields within the scope of the work of Yamantürk Vocational College, 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 College project

The project is expected to increase commercial activity in Germencik and across the district. With the project of Yamantürk Vocational College, it will be possible for the region's rich geothermal resources to be used in the most appropriate way with qualified workforce resulting with the employment.

Thanks to the university expected to play an important role in R&D projects, Germencik district will make progress in becoming a brand town in terms of education. In order to raise students using the opportunities of the information age in the best way under the light of modern science, creating value, being innovative, developing projects, environmentally conscious, knowing the best way to exploit natural and cultural resources, the abovementioned Vocational College project is being supported by the investing company.

A view of the construction of Yamantürk Vocational College project is given below, and the facility is planned to be operational in one year.



Figure 117 Construction of Yamantürk Vocational College, January 2017

III.3.2. Environmental Cost-Benefit Analysis

The project is expected to contribute significantly to the national electrical energy network. Geothermal power plants are activities that support environmental protection, since they are the cleanest source of energy with a good planning and design.

One of the activities with minimum environmental impact among renewable energy sources is geothermal power plants. The fact that the energy-loaded fluid extracted from the ground is re-injected to the ground after being used for electricity generation ensures the sustainability of energy production. Furthermore, these plants are pretty environmentally friendly investments since they do not require modification of natural setting, reduction in the amount of water in stream beds, or major construction activities, unlike hydroelectric power plants.

Besides all these benefits, the weaknesses of these projects are as follows: it is difficult to find an appropriate place for a geothermal power plant; every geothermal source is not suitable for energy generation; and generation must take place where the geothermal source is located.

Noise and dust will occur during the phases of land preparation, construction, and operation of the Project. Furthermore, domestic solid waste and wastewater shall occur because of the workers in the site facilities and sections where daily construction work take place. 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, hazardous wastes shall be managed within the scope of the project in accordance with the relevant 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 more cleaner compared to electricity generation types such as nuclear plants, thermal plants, etc.,
- The country uses its renewable sources,
- It will enable the country to close its energy deficit,
- Roads within and around the project site will be improved,
- Unemployment rate of the region will be reduced,
- It will prevent young people from emigrating,
- New business areas will be opened and economic mobility will be provided.

III.3.3. Expropriation and/or resettlement

The activity, which is the subject of the project, is planned to be carried out on the 36,705.33-m² area in total composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm. Since the plots belong to the investing company, there will be no expropriation.

The project site is within an agricultural land according to 1/100,000-scale Environmental Plan of the Aydın-Muğla-Denizli Region. 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.

The provisions of the Mining Law no. 5686 on "Geothermal Resources and Natural Mineral Waters" shall be observed within the scope of the project.

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 main category to be affected by the project is the local people living in residential areas close to the project site. Locals living in the region and making a living within the region will be affected primarily by the project. In addition, people living in neighborhoods of the vicinity will be affected indirectly. In Chapter II, distances of the residential areas located within the project site and its close vicinity to the project units is given in detail.

During the EIA studies related to the project, the work 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 thoughts of the local people on the subject.

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 the conference hall of the Germencik Municipality 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.

For the Public Participation Meetings, informative correspondence was carried out with the residential areas to be potentially affected by the project, and an announcement including the content, date and hour of the meeting was published in national and local newspapers; thus a lot of people participated in the meeting. Furthermore, these announcement texts were sent to the relevant headmen of the residential areas close to the project site, and people had been notified of the information about the meetings by means of public address systems.

The Public Participation Meeting within the scope of "Efe-8 Geothermal Power Plant" project, was announced to notify the time and venue of the meeting for the participation of people in Aydın Province through a local newspapers (10.12.2016 dated Ses) and a national newspaper (10.10.2016 dated Hürses).



Figure 118 Advertisements in nation-wide and local newspapers

A public participation meeting for the intended "Efe-8 Geothermal Power Plant" project was held in the Conference Hall of the Germencik Municipality in Germencik District of Aydın Province at 13:30 on 23.12.2016.



Figure 119 Views from the public participation meeting - 1



Figure 120 Views from the public participation meeting - 2



Figure 121 Views from the public participation meeting - 3

The participants of the Public Participation Meeting were provided with details of the activity by means of a visual presentation involving explanations regarding the "Efe-8 Geothermal Power Plant", which is the subject of the project. Questions about the project were answered by the representatives of Almer Proje Ltd. Şti. and Gürmat Elektrik Üretim A.Ş., and information on upcoming procedures was given.

The meeting was attended by the representatives of the Ministry of Environment and Urbanization, Aydın Provincial Directorate of Environment and Urbanization, Gürmat Elektrik Üretim A.Ş., and Almer Proje Ltd. Şti. as well as the local people.

The participants of the meeting claimed that there was an air pollution throughout region because of geothermal plants and these plants damaged the agricultural areas. Moreover, they stated that they were disturbed by the steam from the flues of the power plants in the region and asked some questions about the functioning of the plant to be erected under the project.

IV.2. Other parties advised to refer their opinion

If the necessary views and permits regarding the intended project are requested by the commission established by the Ministry of Environment and Urbanization, they will be taken from the relevant institutions and organizations within the framework of the legislation in force.

It is thought that various workshops will be held about the effects of geothermal projects in Aydın province. Finally, Mr. Ömer Faruk KOÇAK, the Aydın Governor, made explanations regarding the issue. In this context, the following news was published in Aydın Ses Newspaper on 18.01.2017.

"A 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 examine it in detail. It's not my specialty, but I'm interested in it to the extent of an administrator. We know geothermal is a useful thing. When geothermal companies came to Aydın, there was a great excitement. After a certain period of time, this excitement has gradually become a apprehension and conflict. It is now becoming a polarization. If there is polarization, it will be impossible to accept what someone says by others. Individuals and institutions considering the interests of the public should work to overcome this polarization. There's been a breach of trust. First of all, this has to be eliminated. No one will believe the geothermal companies if they do a research. If geothermal opponents did a study, it would not be convincing. I am saying these things regardless of whether or not they are true. For this purpose, institutions or organizations that are not affiliated with no one or everyone should do this. We intend to do such a study. 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, this can be done by forming a committee. It can be argued how competent this delegation is. Secondly, it can entirely be outsourced to an impartial institution that has no connection to anyone and been 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 the stakeholders."*

Emphasizing the need for the diversification of the use of geothermal resources, Mr. Koçak said *"We are the richest city in Turkey in terms of geothermal resources We use this source unilaterally to generate electricity. As for the capacity, we have the sufficient capacity to change the region even when it is used in an integrated way, such as house heating, industrial use, cooling and heating, greenhouses. The current unilateral use does not mean that this source will not be used for different purposes. This issue must be addressed in the report and the necessary legal arrangements must be done. 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 instead of enhancing our quality of life and serving 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 land reclamation 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, the soil surface will be covered with a selection of appropriate vegetation.

Following the end of the plant's activity, equipment and buildings will be removed and the emerging materials and equipment will be ensured to be utilized as scrap. In general, a land reclamation 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 intended project, it will be ensured that the equipment is provided with regular maintenance and that the equipment that has expired operating life will be renewed and re-commissioned.

V.2. Impacts on existing water sources and measures to be taken

No impact on water resources is expected after the project is closed to operation. The intended Efe-8 Geothermal Power Plant project 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 site, 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 intended project.

As the geothermal fluid used in the facility is re-injected to 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 means of reinjection. Thus, the surface collapses, which are a result of the decrease in reservoir volume due to production, will be minimized.

No seismic effects arising from the activity is expected in any phases of the intended Efe-8 Geothermal Power Plant 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 a source of energy recognized by all nations and circles.

As is known, developments in technology and industry and growth in population exposed the earth to a tremendous energy demand. This demand is largely met by fossil sources. But taking 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 the geothermal energy.

Turkey has a significant geothermal energy potential compared to other countries. The more installed power in electricity generation, the less dependence on foreign energy sources. Furthermore, development of this sector will create employment opportunities. On the other hand, the role of geothermal energy for the use and evaluation of local resources is getting prominent ones more.

Alternatives to the technology of the project

Below criteria were considered for the determination of the technology and capacity of Efe-8 Geothermal Power Plant by Gürmat Elektrik Üretim A.Ş.:

- National power demand
- Advantages in terms of ease and economy of operation compared to other facilities such as thermal and nuclear power plants,
- Geothermal characteristics of the region,
- Ease of service and maintenance,
- Minimum impact in terms of noise pollution,

It is being considered that the costs of the following should now be included in energy costs; losses arising from the distance between the place where energy is used and the place where energy is generated in addition to water and carbon dioxide damage when generating energy by means of conventional methods, problems in transporting gas, solid and liquid fuel and occasional accidents during such transportation, protection of these facilities with security if they are far from residential areas, life-shortening impacts of gases, heat, poisons, acids and ozone emitted by fuels. The concept of electricity from geothermal sources has made a great progress towards being one of the smart solutions due to the fact that the costs of petroleum, gas and coal will increase in time.

The project will generate electrical energy from a 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 the location of the project

Some other geothermal power plants are currently being operated within the boundaries of the licensed field in Germencik District of Aydın Province by Gürmat Elektrik Üretim A.Ş.

It is now intended to implement the Efe-8 Geothermal Power project as a result of the feasibility studies.

One of the factors in selecting the project site is that the geothermal source is sufficient to generate electrical energy within the licensed field. However, the availability of spare parts and qualified personnel in an easy and short time can be listed as an important advantage.

The technology to be used in the operational phase of the activity is a modern and applicable technology, which is still being applied in similar plants. Therefore, it is thought that the technology chosen for energy generation would provide optimum conditions. The technology of the project is capable of being compatible with efforts to minimize the potential environmental effects of the project.

While selecting a location for a geothermal power plant, 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 source, located within the boundaries of Germencik district 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 field, 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 intended Efe-8 geothermal power plant has no other 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)

Article 18 - (3) of the Regulation on Environmental Impact Assessments promulgated in the Official Gazette issue no. 29186 dated 25.11.2014 is as follows: "after receiving and affirmative EIA decision, the project owner shall be obliged to have the reports regarding the start-up and construction period of the investment prepared by the institutions/organizations authorized by the Ministry, and to submit these reports to the Ministry within the periods determined by the Commission".

Article 27/B - (1) of the Regulation on Amendment to the Regulation on Environmental Impact Assessments promulgated in the Official Gazette issue no. 29619 dated 09.02.2016 is as follows: "after receiving and affirmative EIA decision, the project owner shall be obliged to have the progress obtained during the start-up and investment process reported by the institutions/organizations authorized by the Ministry to the Ministry at certain periods".

In the current situation, the letter 2766 of the Turkish Ministry of Environment and Urbanization dated 17.02.2017 is as follows: "*Accordingly, in accordance with the said court law, since no reporting can be made for the start-up and construction period of projects provided with affirmative EIA decisions pursuant to the 28th article of Law 2577, I kindly request the necessary action for discontinuance of practices requiring report forms and making the necessary arrangements to the EIA system*".

For this reason, necessary applications will be made as determined by the General Directorate of EIA Permits and Audits within the scope of the reporting process regarding the start-up and construction period of the investment.

Control processes and disposal methods to be carried out within the scope of the project will be subject to the following schedule.

Table 79. Control schedule

PHASE	SUBJECT	MEASURE
Land preparation and construction phase	Historical, cultural and archaeological assets	In the implementation phase of the project (land preparation and construction), if any cultural or natural property is discovered, works will be ceased immediately and the nearest museum or civil administration will be notified.
	Excavation	Excavation soil to be generated within the scope of the project will be used for filling purposes and any unused portion thereof shall be transported to the area designated by Germencik Municipality.
	Air emissions	In order to minimize the dust emissions that will occur during land preparation and construction, roads will be watered , filling and unloading operations will be done without tossing, and the vehicles will be covered with canvas during transportation and the top of the transported material will be kept at 10% humidity.
	Vehicle emissions	In order to minimize the emissions from the vehicles, 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. Furthermore, they will be warned to carry out loading operations complying especially with the loading standards in accordance with the Traffic Law.
	Ground safety	All construction works within the scope of the project shall be carried out in accordance with the provisions of the "Regulation on Buildings to be Constructed in Disaster Zones".
	Wastewater	Wastewaters to be generated as a result of water use shall completely be of domestic wastewater characteristic. Domestic wastewater shall be accumulated in a sealed septic tank throughout the construction period and sucked by a sewage truck at certain intervals pursuant to the provisions of the "Regulation on Pits to be Constructed in Places not Possible Having Sewage Systems" promulgated in the Official Gazette no. 13783 dated 19.03.1971.
	Solid wastes and packaging wastes	Domestic solid wastes resulting from the personnel working 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 being delivered to the solid waste collection system of Germencik Municipality in certain periods. Iron pieces, steel, sheets, packaging materials and the like solid wastes will be generated during the land preparation and construction phase, but the amount of such wastes is subject change. However, such wastes will be collected as scrap, stored in a suitable place within the project site, and recoverable wastes will be reused and/or delivered to licensed recycling companies. Unrecoverable wastes will be disposed of by being delivered to the solid waste collection system of Germencik Municipality. In brief, the employees shall be warned that dumping any solid waste (food remains, etc.) generated by the employees during the land preparation and construction period to receiving environments, streets or forests is forbidden. Wastes subject to the "Regulation on Control of Packaging Wastes" shall be accumulated separately from other wastes, regardless of their sources, and delivered to licensed companies pursuant to the regulation.
	Waste oil	The maintenance, repair and cleaning procedures on the vehicles to be operated during the field preparation and construction phase shall not be carried out within the project site, but such procedures shall be done by closest authorized service and/or fuel stations. However, if it is inevitable to carry out a maintenance procedure on a vehicle within the project site, the potential waste oil shall be disposed of in other wastes.
	Vegetable waste oil	Used frying oils to be generated by the dining hall within the facility area shall be collected in a clean and lidded container separate from other wastes. 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 "Regulation on Control of Waste Oils" promulgated in the Official Gazette issue no. 29378 dated 06.06.2015 shall be observed while disposing of vegetable waste oils.
	End-of-life tires	All end-of-life tires shall be collected separately from other wastes and sold to licensed companies. In this context, the conditions stipulated by the "Regulation on Control of End-of-life Tires" promulgated in the Official Gazette issue no. 26357 dated 25.11.2006 shall be fulfilled.

PHASE	SUBJECT	MEASURE
Land preparation and construction phase	Waste batteries and accumulators	In order to prevent end-of-life batteries and accumulators from being delivered to the receiving environment, either directly or indirectly, and harming the public health and environment, they shall be disposed of by being accumulated separately from domestic wastes and delivered to licensed collection points or temporary storages as specified in Article 13 of the "Regulation on Control of Waste Batteries and Accumulators" promulgated in the Official Gazette issue no 25569 dated 31.08.2004.
	Medical wastes	Although it is not possible to foreseen the amount of waste to be generated by the infirmary for the treatment of health problems of employees during the land preparation and construction phase, it is estimated that it will be a very small amount. The conditions stipulated by the "Regulation on Control of Medical Waste" promulgated by the Official Gazette issue no 29959 dated 25.01.2017 shall be complied with for medical wastes.
	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 project site, 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
	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 they cannot be met from the residential areas around the project site. The personnel shall be able to use healthcare centers in Germencik district.
	Public safety	Warning signs, barriers, strips etc. shall be deployed during the work to prevent the project from causing loss of life and property.
	Transportation	Attention shall be paid for the following points within the scope of the project: all transportation shall be through the existing roads, goods supplied shall be brought alternately, all the vehicles and equipment to be used will be routinely controlled, the vehicles requiring maintenance will receive maintenance and other vehicles will be employed until maintenance procedures are completed, and especially loading hauling operations will be done in accordance with loading standards. The Road Traffic Law as well as all the laws and regulations
	Occupational health and occupational safety	The construction phase of the project shall be carried out in accordance with the Labor Law as well as all the regulations enacted with regard to this law.
Operational phase	Solid wastes and packaging wastes	Domestic wastes shall be collected in closed dumpsters placed at various points within the project site, and it shall be disposed of by being delivered to the solid waste collection system of Germencik Municipality. Recoverable wastes generated during the operation phase of the project as a result of faulty packaging shall be collected separately from all other solid wastes and delivered at certain intervals to a contracted company having a license for collecting packaging wastes pursuant to the "Regulation on Control of Packaging Waste" promulgated in the Official Gazette no. 28035 dated 24.08.2011. Unrecoverable solid wastes will be disposed of by being delivered to the solid waste collection 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 working in the operational building shall be provided with protective wear and supplies such as earlaps, earplugs, etc as stipulated in the "Labor Law" within areas with high level of noise, so they will not be affected by noise.
	Land reclamation	As for the landscaping to be done after the completion of the construction phase, the area destructed shall be rehabilitated first, and it shall be ensured that the area recovers its natural landscaping value. In this way, impacts on the environment during the construction and use phases will be minimized, sustainability will be supported in the area, erosion control will be ensured against the potential erosion risk arising from the vegetation destructed and stripped topsoil and slope during the construction and operation phases, whereas the regional and local character will be reinforced.

PHASE	SUBJECT	MEASURE
Operational phase	Wastewater	Wastewaters to be generated as a result of water use shall completely be of domestic wastewater characteristic. Domestic wastewater shall be accumulated in a sealed septic tank throughout the construction period and sucked by a sewage truck at certain intervals pursuant to the provisions of the "Regulation on Pits to be Constructed in Places not Possible Having Sewage Systems" promulgated in the Official Gazette no. 13783 dated 19.03.1971.
	Vehicle emissions	In order to minimize the emissions from the vehicles, 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, whereas the provisions of the "Regulation on Control of Exhaust Emissions and Quality of Gasoline and Diesel Fuel" promulgated in the Official Gazette issue no. 28837 dated 30.11.2013 shall be complied with. They will be warned to carry out loading operations complying especially with the
	Air emissions	As for emissions resulting from all plants, the limits stipulated in RIAPC shall be complied with and necessary measures shall be taken. All the provisions of the "Regulation on Industrial Air Pollution Control" promulgated in Official Gazette issue no. 27277 dated 03.07.2009 shall be complied with.
	Flood prevention and drainage	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. Furthermore, insulation measures at basement levels against surface and leakage waters as well as drainage measures under foundations shall be taken.
	Solid waste	Recoverable and unrecoverable solid wastes will be collected separately in closed containers placed at various points of the project site. Recoverable wastes will be disposed of by being delivered to licensed recovery companies, whereas unrecoverable wastes will be disposed of by being delivered to the solid waste collection system of Germencik Municipality. Employees shall be warned it is forbidden to dump domestic solid wastes (organic wastes such as food remains) to seas, lakes or the like receiving environments, streets, or forests. The provisions of the Waste Management Regulation shall be complied with.
	Packaging wastes	Packaging papers, plastic bottles, glass bottles, etc. wastes shall be accumulated separate from other wastes, regardless of the material used and the source of waste, and sold to licensed recovery companies pursuant to the 23 rd article of the "Regulation on Control of Packaging Waste". In case of packaging wastes classified hazardous, they will be disposed of by being delivered to relevant licensed companies, and such wastes will be transported by means of licensed vehicles.
	Waste oils	End-of-life waste oils within the scope of the project shall be disposed of in licensed disposal facilities as stipulated in Section 2 of the "Regulation on Control of Waste Oils" promulgated in the Official Gazette issue no 26952 dated 30.07.2008. In addition, waste oils and solid wastes contaminated with hazardous substances will be disposed of by sending them to a licensed hazardous waste disposal facility. The conditions stipulated by the "Regulation on Control of Waste Oils" shall be fulfilled, so waste oils shall be collected separately in temporary storages in compliance with standards within the enterprise and transported in accordance with their categories. Waste oils shall be transported to disposal facilities by a licensed transport company. As stipulated in the 9 th article of the "Regulation on Control of Waste Oils", the obligations of the waste oil producer shall be complied with.
	Vegetable waste oils	Used frying oils to be generated by the dining hall within the facility area shall be collected in a clean and lidded container separate from other wastes. 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 "Regulation on Control of Waste Oils" promulgated in the Official Gazette issue no. 29378 dated 06.06.2015 shall be observed while disposing of vegetable waste oils.
	Waste batteries and accumulators	In order to prevent end-of-life batteries and accumulators within the enterprise from being delivered to the receiving environment, either directly or indirectly, and harming the public health and environment, they shall be disposed of by being accumulated separately from domestic wastes and delivered to licensed collection points or temporary storages as specified in Article 13 of the "Regulation on Control of Waste Batteries and Accumulators" promulgated in the Official Gazette issue no 25569 dated 31.08.2004.
	End-of-life tires	All end-of-life tires shall be collected separately from other wastes and sold to licensed companies. In this context, the provisions of the "Regulation on Control of End-of-life Tires" promulgated in the Official Gazette issue no. 26357 dated 25.11.2006 shall be fulfilled.

PHASE	SUBJECT	MEASURE
Operational phase	Medical wastes	All medical wastes that may occur in the infirmary unit shall be placed in red colored plastic bags which are resistant to puncturing, tearing, exploding; made of original medium-density polyethylene, leak-free, with double bottom seam, with sufficient capacity to carry at least 10 kg and with double layer thickness of 100 micron, without bellows, with "International Biohazard" emblem and "ATTENTION! MEDICAL WASTE" phrase. Bags shall be filled maximum to ¾ level, and their openings shall be tightly tied; and in case deemed required, each bag shall put into another bag with the same specifications to ensure sealing. The contents of medical waste bags will never be compressed; medical wastes will not be removed from the bag, or unloaded or transferred to another container. Wastes with cutting-puncturing features shall be separated from other wastes and placed in plastic or laminated cardboard boxes which are resistant to puncturing, tearing, cracking, exploding, and are water-resistant and leak free, impossible to open and touch the contents, with "International Biohazard" emblem and "ATTENTION! SHARP MEDICAL WASTE" phrase, or containers with same specifications. These storage containers shall be filled maximum to ¾, and they shall be closed and put in medical waste bags. After the cutting-puncturing waste containers are full, they shall never be compressed, opened or emptied. The provisions of the "Regulation on Control of Medical Waste" promulgated by the Official Gazette issue no 29959 dated 25.01.2017 shall be complied with throughout the entire project.
	Noise and vibration	Noise measurements shall be made after the commissioning of the facilities; if the noise exceeds the limits according to noise measurement results, employees shall be provided with protective wear and supplies such as earlaps, earplugs, etc as stipulated in the "Occupational Health and Safety Law" no. 6331.
	Occupational health and occupational safety	In order to prevent all possible risks to human health during the operational phase of the project, all the health and safety rules stipulated by regulations and the Occupational Health and Safety Law No. 6331 shall 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.
	Public safety	Warning signs, barriers, strips etc. shall be deployed during the work to prevent the project from causing loss of life and property.
	Transportation	Attention shall be paid for the following points within the scope of the project: transportation shall be through the existing roads, all the vehicles and equipment to be used will be routinely controlled, the vehicles requiring maintenance will receive maintenance and other vehicles will be employed until maintenance procedures are completed, and especially loading hauling operations will be done in accordance with loading standards. The Road Traffic Law as well as all the laws and regulations related to roads shall be observed with in
	Housing and other technical and social infrastructure needs of the personnel	Personnel to be employed within the project shall be recruited locally as much as possible, whereas the housing and other technical/social infrastructure needed by outsiders shall be provided from Germencik and Incirliova districts and the nearby residential areas.
	Landscaping	Landscaping will be carried out in order to eliminate visual pollution within the scope of the project.

Risk of accident related to the technology and materials to be used in the land preparation and construction period of the intended project is very low, provided that the legislation of occupational health and safety is observed strictly. The policies and procedures related to occupational health & safety shall prevail during every stage of the construction period, whereas all the activities to be carried out shall comply with the provisions of the relevant and current legislation related to occupational health & safety.

An organization shall be built among the personnel in order to be able to response immediately to natural disasters such as floods and earthquakes and emergencies as a result of fires, sabotages or industrial accidents, and to minimize the damage and prevent its environmental impacts. Protection, Fire, Rescue and First Aid Teams shall be built up within this organization. The working principles of these teams will be determined separately and a General Coordinator will be assigned to be responsible for all these organization processes.

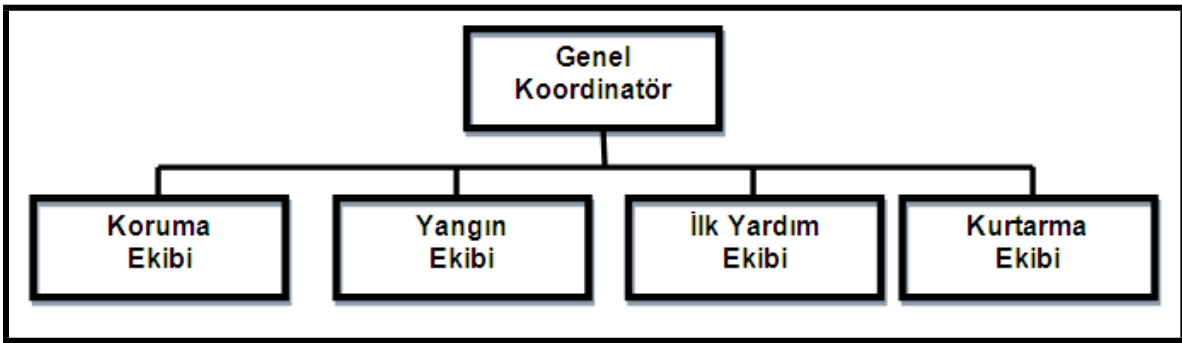


Figure 122 Coordination structure of the emergency action plan

The order of priority for responding to potential emergency situations that may occur in the plant site shall be as follows:

- ✓ Provision of communication,
- ✓ Provision of transportation and regulation of traffic,
- ✓ Rescue,
- ✓ Medical first aid
- ✓ Transfer of patients and injured to hospital,
- ✓ Fire extinguishing
- ✓ Provision of security and public order
- ✓ Feeding, Clothing, Heating, and Lighting
- ✓ Provision of Temporary Accommodation
- ✓ Burial of the dead
- ✓ Debris removal and cleaning
- ✓ Arrangement of infrastructural facilities
- ✓ Taking Quarantine Measures

The duties and responsibilities of the teams to be formed within the scope of the emergency plan are determined and summarized below:

Duties and responsibilities of the protection team

Duties and responsibilities of the protection team is detailed in the following figure.

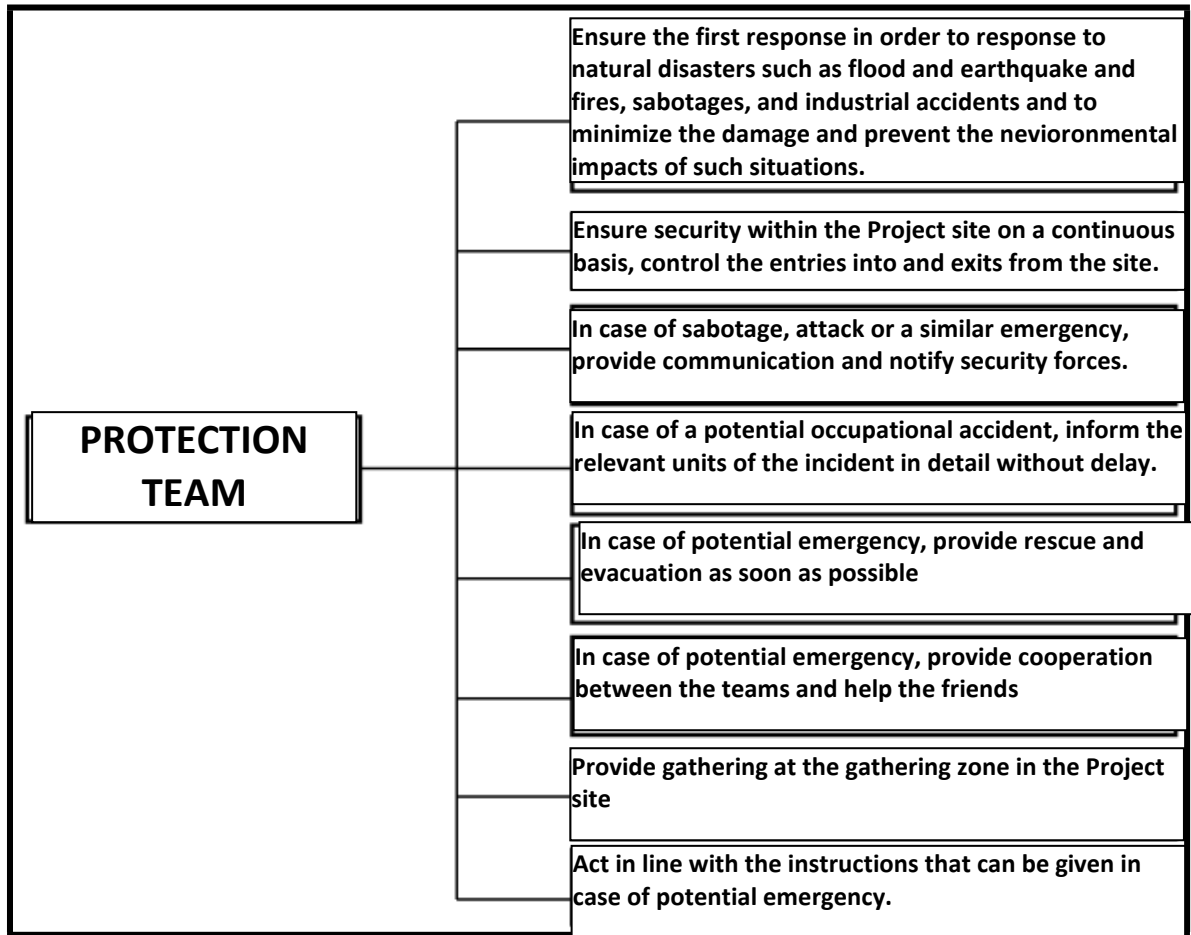


Figure 123 Duties and responsibilities of the protection team

Duties and responsibilities of the rescue team

Duties and responsibilities of the rescue team is detailed in the following figure.

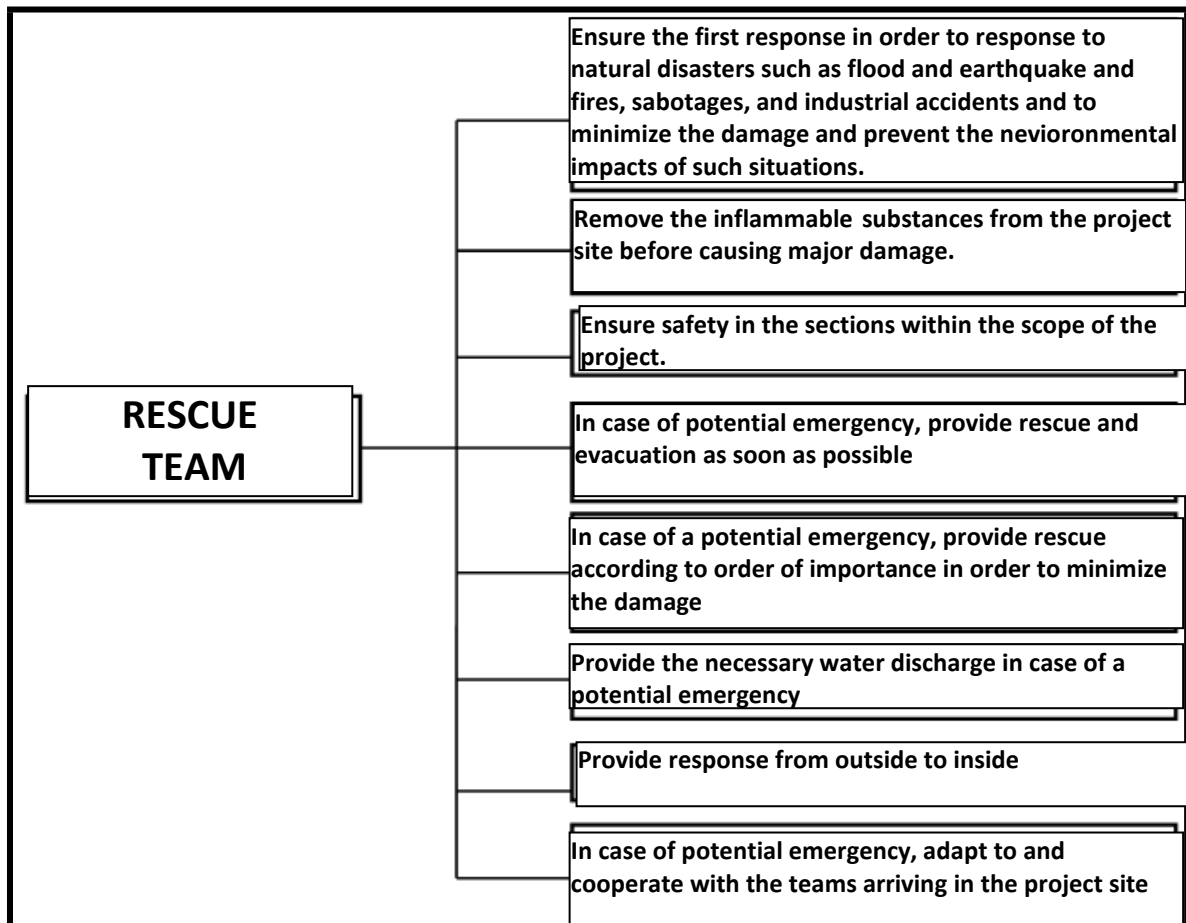


Figure 124 Duties and responsibilities of the rescue team

Duties and responsibilities of the first aid team

Duties and responsibilities of the first aid team is detailed in the following figure.

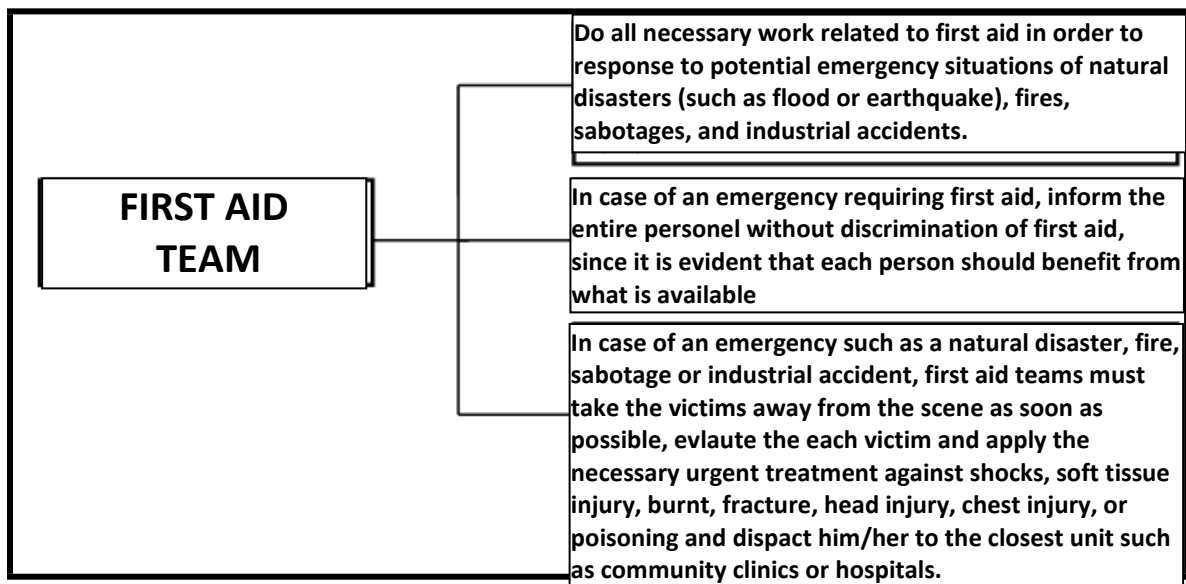


Figure 125 Duties and responsibilities of the first aid team

Duties and responsibilities of the fire fighting team

Duties and responsibilities of the fire fighting team is detailed in the following figure.

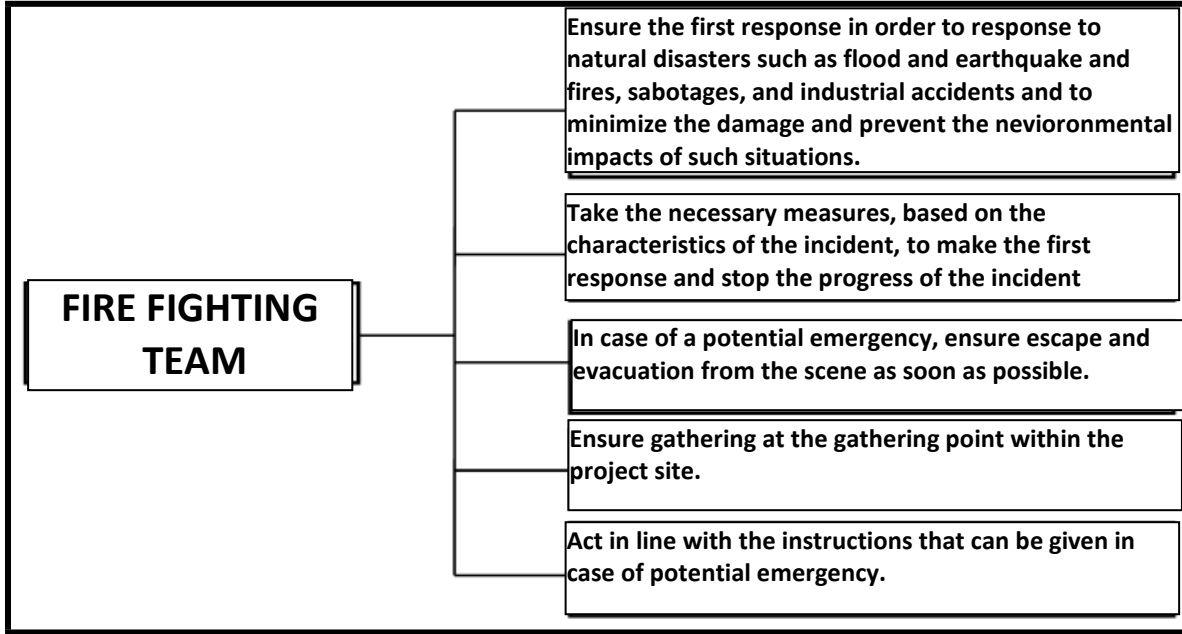


Figure 126 Duties and responsibilities of the fire fighting team

Occupational accidents may occur as a result of possible carelessness while operating vehicles, construction machines, or equipments during the construction period. In order to reduce and prevent all these accidents, the employees will be provided with necessary training and warnings and warning signs will be placed.

The first aid supplies shall be supplied and kept in a first aid closet as stipulated in the "Regulation on Occupational Health and Safety". The measures as stipulated in the "Regulation on Occupational Health and Safety" shall be taken.

Health examination for infectious diseases on the personnel to be employed by the project shall be made on a periodic basis and documented.

As a result, all necessary measures shall be taken during the construction and operation periods of the project. In all stages of the project, the provisions of the Labor Law and the regulations and by-laws already issued and to be issued based on this law shall be complied with, and necessary measures shall be taken to minimize all accidents and risks.

The Emergency Action Plan for the facility, which is the subject of the project, is given in Annex-19.

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, choices among alternatives within the scope of the project and reasons for these choices)

Efe-8 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 36,705.33-m2 area composed of Plots 5, 6, and 7 in Block 115 at Izgar Locality of Ömerbeyli Quarter of Germencik District of Aydın Province, the ownership of which belongs to the investor firm.

Plots 5, 6, and 7 intended to be used for Efe-8 Geothermal Power Plant are at the south of geothermal power plants, which belong to Gürmat Elektrik Üretim A.Ş. and are currently being operated, whereas the pool, switchyard, and workshop units belonging to the existing plants are 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.

Geothermal power plants, geothermal energy and technology in today's world is a renewable source of energy which is unquestionable and recognized by all nations and circles.

As is known, developments in technology and industry and growth in population exposed the earth to a tremendous 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.

Below criteria were considered for the determination of the technology and capacity of the intended Efe-8 GPP:

- National power demand
- Advantages in terms of ease and economy of operation compared to other facilities such as thermal and nuclear power plants,
- Geothermal characteristics of the region,
- Ease of service and maintenance,
- Minimum impact in terms of noise pollution,

The project will generate electrical energy from a geothermal energy source 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 choosing the project site is that the area where a geothermal power plant is to be established has to be within a licensed field and the properties of the relevant geothermal source properties has to be sufficient to produce electrical energy. However, the availability of spare parts and qualified personnel in an easy and short time can be listed as an important advantage.

The technology to be used in the operational phase of the activity is a modern and applicable technology, which is still being applied in similar plants. Therefore, it is thought that the technology chosen for energy generation would provide optimum conditions. The technology of the project is capable of being compatible with efforts to minimize the potential environmental effects of the project.

Examining the existing alternatives in this scope, the Geothermal Power Plant, the capacity of which is intended to be increased, the place and production method chosen for the activity has no other alternative in terms of suitability and economic efficiency.

Potential environmental impacts of the project during the construction phase and the measures to be taken

There will be some construction within the scope of the Efe-8 Geothermal Power Plant project.

20 cm-thick topsoil will be stripped gradually prior to construction, and it will be stored temporarily in a place, the inclination of which does not exceed 5% pursuant to the standards stipulated in the "Regulation on Control of Excavation Soil, Construction And Demolition Waste", and will be used in landscaping works of the site. No crushing and grinding process shall take place for removing the topsoil. No inflammable, explosive, dangerous, toxic or chemical substances will be used during the construction of turbine foundations and new roads. Construction equipment will be used for the work to be done.

The project will require a little amount of reinforced concrete during construction. At this stage, the ready-to-use concrete will be supplied from the market. However, there will be no quarry operation within the scope of the project.

Any surplus excavation material extracted from the site will be accumulated in a suitable place within the site and then reused for landfill and land smoothing. During the excavation works to be done under the project, the provisions of the "Regulation on Control of Excavation Soil, Construction and Demolition Wastes" promulgated in Official Gazette issue no 25406 dated 18.03.2004 shall be complied with.

Dust emission during the construction work of the project will occur. Dust emission during the production, unloading and transportation operations during the construction works in the project site was calculated by taking into consideration the dust emission factors given in the Regulation on Industrial Air Pollution Control.

During the construction phase, all operations will not be done at the same time. Necessary excavations and fillings will be made after the stripping of the soil layer under the project. The construction process of the project will begin with field arrangements.

The construction phase of the project is planned to be completed in 12 months in total.

"Contribution to air pollution" by an internationally recognized distribution model within the sphere of influence of the plant on the ground that pollutants' mass flow stipulated in Annex-2 the RIAPC is exceeded, assuming that all the works to be done at the same time, is not necessary.

In the land preparation and construction phase of the intended project, there will be ambient noise induced by construction machinery and equipment to be operated within the field.

Comparing the noise levels during the construction phase given in the calculations in section III.1.14. of the EIA report with the noise levels stipulated in Table 5 of Annex-VII of RAMAN, it is observed that 70 DBA limit values were obtained after about 125 m distance during the construction phase. Therefore, the construction activities to be carried out within the scope of the intended project will not have any negative impact on the residential areas.

During the construction phase of the project, all the machinery and equipment causing noise will be regularly maintained and renewed after their economic life is over. In addition, it shall be ensured that personal protective equipment (headphones, etc.) are used by the employees working in the facility, noise measurements shall be made periodically.

Some domestic solid waste will be generated by the personnel during the construction phase of the Efe-8 Geothermal Power Plant project. Domestic solid wastes generated by the personnel during the construction phase of the activity shall be collected in separate containers based on their characteristics (organic, glass, plastic, paper, metal, etc.) and kept in sealed containers within the project site without polluting the environment in terms of appearance, dust, odor, etc.

The provisions of the "Waste Management Regulation" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with while collecting, storing, and transporting domestic solid wastes.

Recoverable wastes generated during the construction phase of the project shall be collected separately from all other solid wastes and delivered at certain intervals to a contracted company having a license for collecting packaging wastes pursuant to the "Regulation on Control of Packaging Waste" promulgated in the Official Gazette no. 28035 dated 24.08.2011 and all amendments to that regulation.

The provisions of the "Regulation on Soil Pollution Control and Point-Source Contaminated Sites" promulgated in Official Gazette issue number 27605 dated 08.06.2010 (Amended: OG-14.6.2012-28323, OG-11.7.2013-28704) shall be complied with during the work.

Waste oils likely to occur during the construction phase of the project can be listed as the waste oils that may be released as a result of maintenance and repair operations of work machines to be used and the waste oils likely to occur in case of emergency. Besides, contaminated packages, oakum, contaminated packaging materials, working clothes etc. which is possible to occur can be regarded as hazardous waste.

Maintenance & repair procedures on the construction machines to be operated during the construction phase shall be done by authorized maintenance & repair stations outside the field of activity. However, for the disposal of waste oils likely to occur in cases where it is inevitable to perform maintenance & repair procedures within the project site for machinery and equipment, the provisions of the "Regulation on Control of Waste Oils" promulgated in the Official Gazette issue no. 26952 dated 30.07.2008 (Amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812) shall be complied with.

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.

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, battery replacements will also take place outside the plant. Each accumulator will be delivered to the service station from which the new accumulator is purchased.

Tires likely to result from the vehicles to be operated during the construction phase of the activity shall be disposed of by being stored temporarily in an enclosed and sealed place within the project site and delivered to a company licensed by the Ministry of Environment and Urbanization pursuant to the provisions of the "Regulation On Control Of End-Of-Life Tires" promulgated in the Official Gazette issue no. 26357 dated 25.11.2006 (Amended: OG-30.03.2010-27537, OG-10.11.2013-28817, OG-11.3.2015-29292).

Wastewaters to be generated as a result of water use shall completely be of domestic wastewater characteristic, assuming that 100% of the water to be used will return as wastewater. Domestic wastewater shall be accumulated in a sealed septic tank throughout the construction period and sucked by a sewage truck at certain intervals pursuant to the provisions of the "Regulation on Pits to be Constructed in Places not Possible Having Sewage Systems" promulgated in the Official Gazette no. 13783 dated 19.03.1971. Aydın Metropolitan Municipality's letter promising to receive domestic wastewater by a sewage truck is presented in Annex-23.

All the work to be done in all phases of the project shall comply with the provisions of the "Regulation on Control of Water Pollution" promulgated by the Official Gazette issue no 25687 dated 31.12.2004 (and all the amendments to this regulation).

Potential environmental impacts of the project during the operation phase and the measures to be taken

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.

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. Throughout the economic life of the project, the equipment must be regularly maintained and the equipment whose operating life is over must be replaced. The plant site will be operated for many years with new boreholes to be drilled as long as the sufficiency and usability of the geothermal potential in the region continues.

The residential area closest to the project site is Germencik District which is located approximately 2,000 m northwest. The locations of other residential areas are as follows: Ömerbeyli Quarter is 2.4 km northeast of the project site, Akçeşme Quarter is 3.3 km northeast, Erbeyli Quarter is 2.5 km east, Sınırteke Quarter is 2.1 km southeast, and Reisköy Quarter is 4.25 southwest. The distance of the activity area to Aydın city center is approximately 18 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 as follows: CO₂, N₂, CH₄, NH₃, H₂S, and H₂. CO₂, which is approximately 99% by volume, has an important place compared to other gases.

The maximum hourly value and STL values obtained by modeling for H₂S emissions that are likely to occur from all plants within the licensed field during the operation phase of the project provide the limit values (hourly and STL) specified in RIAPC Table 2.2.

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 RIAPC limit values and therefore the activity will not pose any danger to human and environmental health. It is assumed for the modeling that all power plants are in operation and emission distribution is compatible with the existing technologies; whereas processes with higher H₂S treatment efficiency thanks to 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 stated in the Regulation on Industrial Air Pollution Control. In this context, 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 mating surfaces as well as operational problems will be prevented.

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.

A total of 17 wells will be used for production and reinjection within the scope of the project. 9 production and 8 reinjection wells are planned to be used within the scope of the intended activity. Only piping works will be done in the existing wells, but drilling will take place prior to piping only in the wells to be drilled from scratch.

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 small amount of excavation waste will be generated during well drilling. The excavation to be formed will be stored at a point of the drilling area. After the drilling process is completed, part of the excavation will be used for filling the mud pond. Any excavation waste which is not possible to be utilized, if any, will be disposed of by transporting to the waste disposal sites of Germencik Municipality and/or Aydın Metropolitan Municipality.

The geothermal fluid to be supplied at a rate about 2,500 tons/hour from 9 production wells within the scope of the project will be used by Efe-8 Geothermal Power Plant. 99% of this fluid will be re-injected to the ground after energy generation.

In the case of reinjection wells, a potential failures in the closed circuit of the source can be seen immediately in the control center through the automation system and can be intervened from there. For the possible malfunctions in the reinjection system, a 7,500 m³ storage pool in the existing Efe 1-3-4 GPP campus will be used. The pool will be able to store 2,500 tons/hour of geothermal source to be used in the system for 3 hours. In case of prolongation of a malfunction, production wells shall be shut down through the automation system and the flow of geothermal sources is stopped. Therefore, no geothermal fluids will be transferred from the facility.

No detonation will take place within the project site. 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 site, and no operations shall be carried out preventing the free flow of water.

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

Residential areas, surrounding lands and stream bed shall not be damaged during construction and operation activities, and DSI shall not be held legally liable for any kind of damage, floods and water pollution problems resulting from any improper practices.

Water shall not be used from the irrigation canals located around the said project site without the permission of DSI. Furthermore, absolutely no discharge to facilities commissioned by DSI (irrigation and drainage canals, stream beds, etc.) shall take place.

In order to use agricultural lands under the project for non-agricultural purposes, necessary permits shall be obtained from Aydın Provincial Directorate of Food, Agriculture and Livestock and/or the Ministry of Food, Agriculture and Livestock pursuant to the Soil Conservation and Land Use Law no. 5403 promulgated in the Official Gazette issue no. 25880 dated 19.07.2005.

The provisions of the "Regulation Waste Oil Control" promulgated in the Official Gazette no. 26952 dated 30.07.2008 (Amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812) shall be complied with during all the works to be done within the project site.

The provisions of the "Waste Management Regulation" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with for any hazardous wastes occurring in any stage of the project.

In addition, the provisions of the "Waste Management Regulation" promulgated in Official Gazette issue no 29314 dated 02.04.2015 shall be complied with for any hazardous wastes occurring in any stage of the project.

As a conclusion,

Potential environmental impacts arising from the intended project and the control measures to be taken against these impacts have been evaluated in the relevant sections of the EIA report, and all the commitments mentioned in the report shall be complied with during the operation phase the project.

The laws and regulations to be followed during the construction and operation phases of the project are listed below:

- ✓ *Environmental Law No. 2872 and Law No. 5491 on Amendments to the Environmental Law*
- ✓ *Occupational Health and Safety Law No. 6331*
- ✓ *Forest Law No. 6831*
- ✓ *Pasture Law No. 4342*
- ✓ *Olives Law No. 4086*
- ✓ *Soil Conservation and Land Use Law No. 5403*
- ✓ *Fisheries Law No. 1380 and the relevant regulation*
- ✓ *Regulation on occupational health and occupational safety (OG 14765 dated 11.01.1974)*
- ✓ *Regulation on occupational health and safety in construction (OG 25325 dated 23.12.2003)*

- ✓ *-Regulation on Assessment and Management of Environmental Noise (OG 27601 dated 04.06.2010) (Amended: OG-27.4.2011-27917)*
- ✓ *Regulation on waters for human consumption (OG 25730 dated 17.02.2005) (Amended: OG-31.7.2009-27305, OG-7.3.2013-28580, OG-11.4.2014-28969)*
- ✓ *Regulation on control of excavation soils, construction and demolition wastes (OG 25406 dated 18.03.2004) (Amended: OG 27533 dated 26.03.2010)*
- ✓ *Regulation on Industrial Air Pollution Control (OG 27277 dated 03.07.2009) and all the amendments to the regulation*
- ✓ *Regulation on Assessment and Management of Air Quality (OG 26898 dated 06.06.2008)*
- ✓ *Regulation on Control of Water Pollution (OG 25687 dated 31.12.2004) and all amendments to this regulation*
- ✓ *Regulation on Protection of Wetlands (OG 25818 dated 17.05.2005) (Amended: OG 27684 dated 26.08.2010)*
- ✓ *Regulation on Control of Packaging Wastes (OG 28035 dated 08.24.2011)*
- ✓ *Regulation on Control of Waste Oils (OG 26952 dated 30.07.2008) and all amendments to this regulation (Amended: OG-31.07.2009-27305, OG-30.03.2010-27357, OG-05.11.2013-28812)*
- ✓ *Regulation on Control of Vegetable Waste Oils (OG 25791 dated 19.04.2005) (Amended: OG 27537 dated 30.03.2010)*
- ✓ *Regulation on Soil Pollution Control and Point-Source Contaminated Sites (OG 27605 dated 08.06.2010) (Amended: OG-14.6.2012-28323, OG-11.7.2013-28704)*
- ✓ *Regulation on Control of End of Life Tires (OG 26357 dated 11.25.2006) (Amended: OG-30.03.2010-27537, OG-10.11.2013-28817, OG- 11.3.2015-29292)*
- ✓ *Regulation on Exhaust Gas Emission Control and Gas and Diesel Fuel Quality (OG 28837 dated 30.11.2013)*
- ✓ *Regulation on Control of Waste Batteries and Accumulators (OG 25569 dated 31.08.2004) and all amendments to this regulation (Amended: OG-03.03.2005/25744, OG-30.03.2010/27537, OG-5.11.2013-28812, OG-23.12.2014-29214)*
- ✓ *Regulation on Pits to be Constructed in Places not Possible Having Sewage Systems (OG 13783 dated 03.19.1971)*

- ✓ *Regulation on Environmental Permits and Licenses (OG 29115 dated 10.09.2014)
(Amended: OG 29117 dated 12.09.2014)*
- ✓ *Regulation on Buildings to be Constructed in Disaster Zones (OG 26582 dated
07.14.2007)*
- ✓ *Regulation on Control of Medical Wastes (OG 29959 dated 01.25.2017)*
- ✓ *Soil Conservation and Land Use Law No. 5403 and the relevant bylaw and
regulation*
- ✓ *Regulation on Waste Management (OG 29314 dated 04.02.2015)*
- ✓ *Regulation on Waste Landfills (OG 27533 dated 26.03.2010) (Amended: OG
29292 dated 11.03.2015)*