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Translation

BANDIRMA NATURAL GAS COMBINED CYCLE POWER PLANT

ENVIRONMENTAL IMPACT ASSESSMENT REPORT



EIA Report



Final EIA Report



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Project Name :	Bandirma Natural Gas Combined Cycle Power Plant
Project Location:	Balıkesir Province, Bandirma District, Sirincavus Village
Description and Purpose of the Project :	Establishment of Bandirma Natural Gas Combined Cycle Power Plant with an installed capacity of 930.75 MWe

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ABBREVIATIONS

C	Centigrade
cm	centimeter
CO	Carbon monoxide
CO₂	Carbon dioxide
dBA	A-Weighted decibel
EIA	Environmental Impact Assessment
EMRA	Energy Market regulatory Authority
ENERJISA	ENERJISA Energy Generation Inc.
g	gram
GDP	Gross Domestic Product
GTG	Gas Turbine Generator
ha	hectare
kcal	kilocalorie
kg	kilogram
km	kilometer
kPa	kilopascal
kV	kilovolt
kW	kilowatt
L	Liter
LTL	Long Term Limit
m	meter
MENR	Ministry of Energy and Natural Resources
mg	milligram
mm	millimeter
MoEF	Ministry of Environment and Forestry
MW	megawatt
MWe	Megawatt electrical
NGCCPP	Natural Gas Combined Cycle Power Plant
no.	Number
NO_x	Nitrogen Oxides
PM	Particulate Matter
RAMEN	Regulation on Assessment and Management of Environmental Noise

RCAPOIE	Regulation on Control of Air Pollution Originated from Industrial Establishments
RPAQ	Regulation on Protection of Air Quality
s	second
S	South
SHW	State Hydraulic Works
SMS	State Meteorological Service
SO₂	Sulfur Dioxide
SPO	State Planning Organization
STG	Steam Turbine Generator
STL	Short Term Limit
t	ton
TURKSTAT	Turkish Statistical Institute
WPCR	Water Pollution Control Regulation
°	Degree
%	Percent

I. DESCRIPTION AND PURPOSE OF THE PROJECT**(Description, Project Life, Means of Service, Markets or Service Area of the Project, Its Importance and Necessity within This Area with respect to the Economic and Social Aspects of the Country, Region and/or Province)**

The energy that is one of the most important problems of our century is a great concern for developing countries like Turkey and has become one of the production factors such as labor force, capital and soil which are becoming costly in time. Energy variety also increases in parallel with this situation.

After the petroleum crises in 1970s, connection of gas sector started to expand by progressive stages. Depending on this development natural gas became one of the most important energy resources.

Natural gas is a "clean" energy resource that does not pollute the environment and air. Because there are not sulfur oxides and particulate matter (PM) in the composition of natural gas, these pollutants will not be produced from the combustion of natural gas. The use of natural gas is becoming widespread in the world and an important preference with its high thermal value and other characteristics. It is a productive fuel. Because of its gaseous state and there is high probability for combination of flammable molecules, it is possible to burn it in a more efficient way.

Additionally, controlling of natural gas power plants automatically provides both time savings and energy savings. It is possible to put into service easily and in a short time. For that reason it can be used together with automatic control. Also the fact that it works with fast assembling systems provides advantages.

Control of combustion can be made easier in the systems utilizing natural gas and a constant efficiency is obtained. Combustion efficiency of natural gas is higher than coal and equals to the fuel oil. Because there are no remaining substances such as ash after combustion, there will not be any additional costs. Moreover, natural gas provides the possibility of continuous and uninterrupted use.

In Turkey natural gas sector particularly made an important leap especially with the start of gas import from old Soviet Union in 1987. Factors such as high efficiency, supply elasticity and low investment cost have brought the use of natural gas in Combined Power Plants in the foreground.

The latest developments such as construction of energy transmission lines planned to be extended to Black Sea, Aegean and South Regions in Turkey and capacity increase projects for electricity generation indicate that the demand for natural gas will increase day by day.

Gross electricity consumption of Turkey (Gross electricity generation of Turkey + import/export) has reached to 160.8 billion kWh with 7.2 % increase in 2005 and 174.2 billion kWh with 8.3 % in 2006. Net consumption in Turkey was 129.5 billion kWh in 2005 and 141.1 billion kWh in 2006.

Instantaneous peak demand and energy demand of Turkey interconnected electricity system by years are presented Table I-1. In 2005 peak demand was 25,174 MW and minimum load was 10,120 MW. In 2006 peak demand was 27,594 MW and minimum load was 10,545 MW. While the ratio of minimum load to peak load was 40 % in 2005, this ratio became 38 % in 2006. That is, in 2006 base load part of load curve of the system decreased when compared with the curve in 2005 and a bad consumer curve was formed (see Figure I-1). Thus 38 % of the electricity generated by power plants constituting the electricity generation system of 2006 was utilized along the year and the remaining amount was utilized for shorter periods.

In other words, it was observed that base load requirement decreased in 2006 while it was expected to increase.

Table I-1. Peak Demand and Energy Demand of Turkey Electricity System Between 1997 - 2006

YEARS	PEAK DEMAND (MW)	INCREASE (%)	ENERGY DEMAND (GWh)	INCREASE (%)
1997	16926	11.1	105517	11.3
1998	17799	5.2	114023	8.1
1999	18939	6.4	118485	3.9
2000	19390	2.4	128276	8.3
2001	19612	1.1	126871	-1.1
2002	21006	7.1	132553	4.5
2003	21729	3.4	141151	6.5
2004	23485	8.1	150018	6.3
2005	25714	7.2	160794	7.2
2006	27594	9.6	174230	8.3

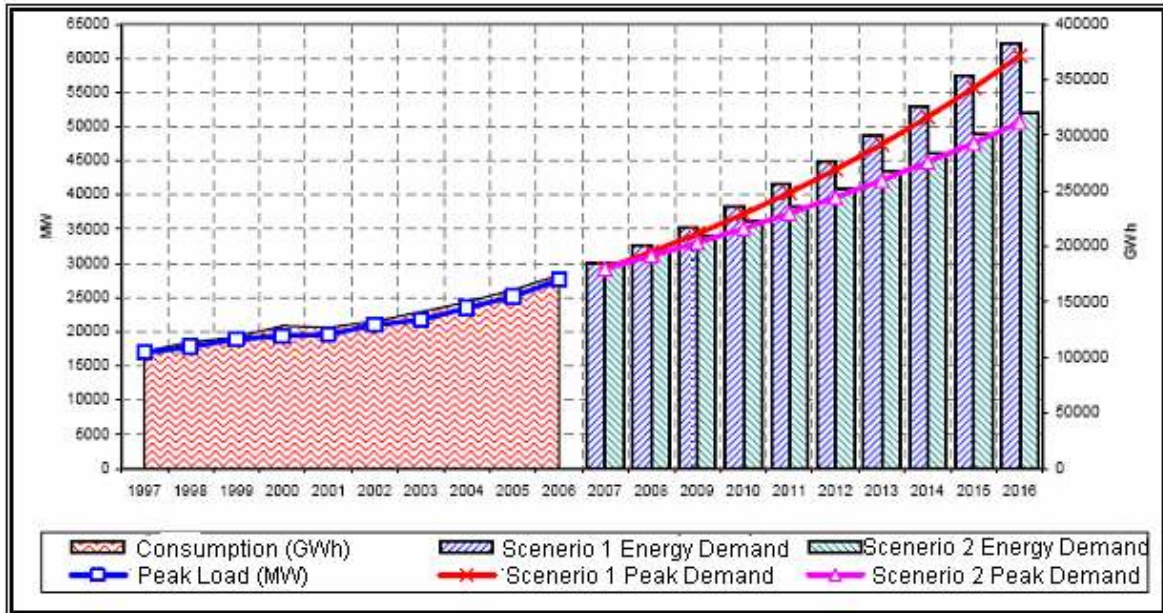


Figure I-1. Peak Power and Energy Demand of Turkey Electricity System Between 1997 - 2006

Load curves of the days when the maximum and minimum electricity demand occur in 2006 are shown in Figure I-2 and Figure I-3. In 2006, peak demand on the maximum consumption day was 27,594 MW and minimum load was 17,309 MW.

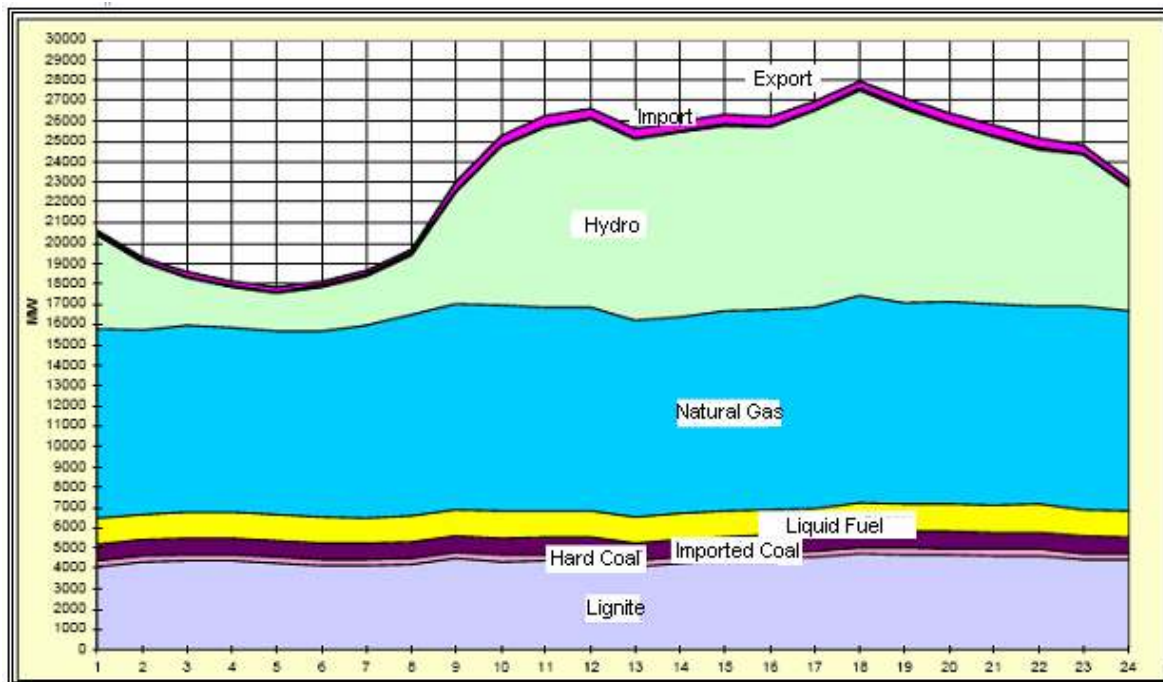


Figure I-2. Operation Status of Power Plants with respect to Energy Sources when the Electrical Energy Consumption of the Year 2006 was Maximum (December 27, 2006)

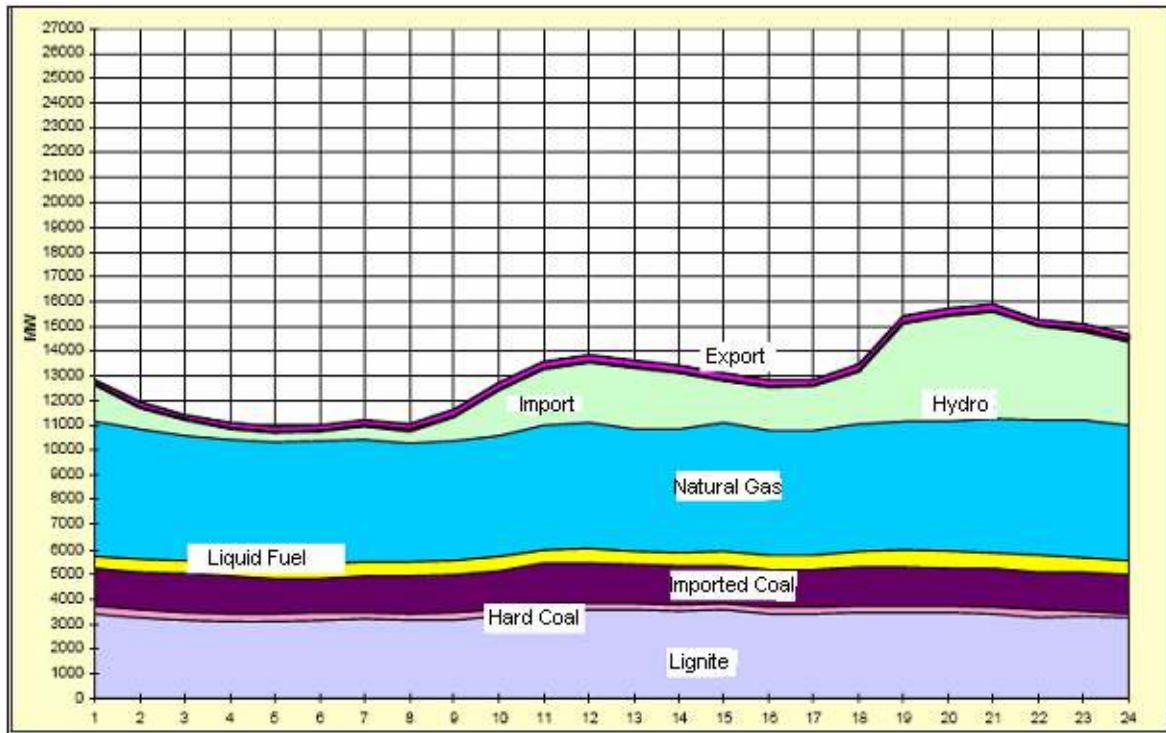


Figure I-3. Operation Status of Power Plants with respect to Energy Sources when the Electrical Energy Consumption of the Year 2006 was Minimum (October 24, 2006)

For the Generation Capacity Projection study covering 2007–2016 period, energy demand in 2006 was taken as a base and by using annual demand increase rates specified in line with the results of demand forecast study implemented by the Ministry of Energy and Natural Resources (MENR) with two alternatives, re-arranged Scenario 1 and Scenario 2 demand series was used.

Realization analyses of Demand Forecast studies prepared by MENR are given in Figure I-2 and Figure I-3¹.

Realization ratio of the forecasts has close relation with the realization ratio of development growth rate.

When the Gross Domestic Product (GDP) growth rates used for the demand forecast studies are compared to realized values, it was determined that deviations in the target increase rate used in demand studies were at +10 % and –5 % except crisis years.

In case that data used in model are closer to real values, realization of forecasts will be closer to forecasts for the short-term and mid-term, but deviations will be larger for the longer term parallel to used data.

Demand projections carried out by MENR in 2004 are based on various scenarios and sensitivity analysis. Two of these projections are: Scenario 1 which is calculated by

¹ Study Report on Long-term Electrical Energy Demand of Turkey (MENR-RPC)

State Planning Organization (SPO) and based on the contribution to GDP by agriculture, mining, manufacturing, energy, construction, transportation and other service sectors up to 2020 and thus GDP amount composed of these sector's total, and Scenario 2 established to show the sensitivity of changes on the sub sectors of manufacturing which is sub component of GDP. Generation Capacity Projection is prepared by taking into account these two scenarios.

The development of main inputs used for demand forecasts is assumed as follows.

The amounts of GDP and its detail as of sub-sectors are the same for Scenario 1 and Scenario 2, but the effect of different developments of sub sectors on electricity demand projections is studied in Scenario 2.

It was considered that the population which was 67.5 millions in 2000 would increased at the rate of 1.6 % in 2005, 1.4 % in 2004-2010 period, 1,2 % 2010-2015 period and 1 % in 2015-2020 period and would become 73 million in 2005, 78.5 millions in 2010, 83.3 millions in 2015 and 87.8 millions in 2020 respectively.

Development rate, GDP and population growth rates specified by undersecretary of State Planning Organization in 2004 are as follows.

Table I-2. Development and Population Growth Rates by Years

Periods	Development Rate (%)	Population Growth Rate (%)
2000-2005	3.1	1.6
2005-2010	5.5	1.4
2010-2015	6.4	1.2
2015-2020	6.4	1.0

Source: Study Report on Long-term Electrical Energy Demand of Turkey (MENR)

Development structure of GDP by sectors with respect to development rates is presented in Table I-3.

Table I-3. Sectoral Structure of GDP (% share)

	2000	2005	2010	2015	2020
Agriculture	13.4	11.9	10.6	9.4	8.4
Constructions	5.0	4.2	4.9	5.5	5.5
Mining	1.4	1.0	0.8	0.7	0.6
Manufacturing	23.8	24.6	24.1	23.8	23.6
Energy	3.2	3.5	3.8	4.0	4.3
Services	53.2	54.8	55.8	56.6	57.6
TOTAL	100.0	100.0	100.0	100.0	100.0

Source: Study Report on Long-term Electrical Energy Demand of Turkey (MENR)

As it is seen in Table I-3, the contribution of agriculture and mining sectors to national income is expected to decrease in time, the contribution of manufacturing sector is expected to increase in the first 5-year period but to decrease slowly in the latter periods.

It is also expected that the share of energy and construction sectors will increase in the long term, but the highest increase is expected in service sector.

Scenario 1 (High Scenario) and Scenario 2 (Low Scenario) that are the demand forecast series and their increases by the years are presented in Table I-4, Figure I-4 and Table I-5, Figure I-5, respectively.

It is assumed that the ratio of minimum load to peak load will be around 40% for 2007 and the following years, in other words it is expected that the characteristics of the load curve will remain similar. In the case that an increase is provided for this rate, it is a matter to be considered that it will ensure the contribution to supply dependability.

Demand forecasts are gross estimations and valid for Turkey Electricity System. Losses in the transmission and distribution lines and internal requirements of the power plants are included. Additionally embedded generation (connected to the distribution system) and the generation of the plants which are not subject to Load Dispatching instructions are included too.

Table I-4. Demand Forecast (Scenario 1, Adjusted High Scenario)

YEAR	PEAK DEMAND		ENERGY DEMAND	
	MW	Increase (%)	GWh	Increase (%)
2007	29829	8.1	188343	8.1
2008	32275	8.2	203787	8.2
2009	34954	8.3	220701	8.3
2010	37855	8.3	239019	8.3
2011	40997	8.3	258858	8.3
2012	44359	8.2	280084	8.2
2013	47908	8.0	302491	8.0
2014	51692	7.9	326388	7.9
2015	55724	7.8	351846	7.8
2016	59904	7.5	378234	7.5

Source: Study Report on Long-term Electrical Energy Demand of Turkey (MENR)

The electricity demand is 188,343 GWh in 2007 and is expected to be 378,234 GWh in 2016.

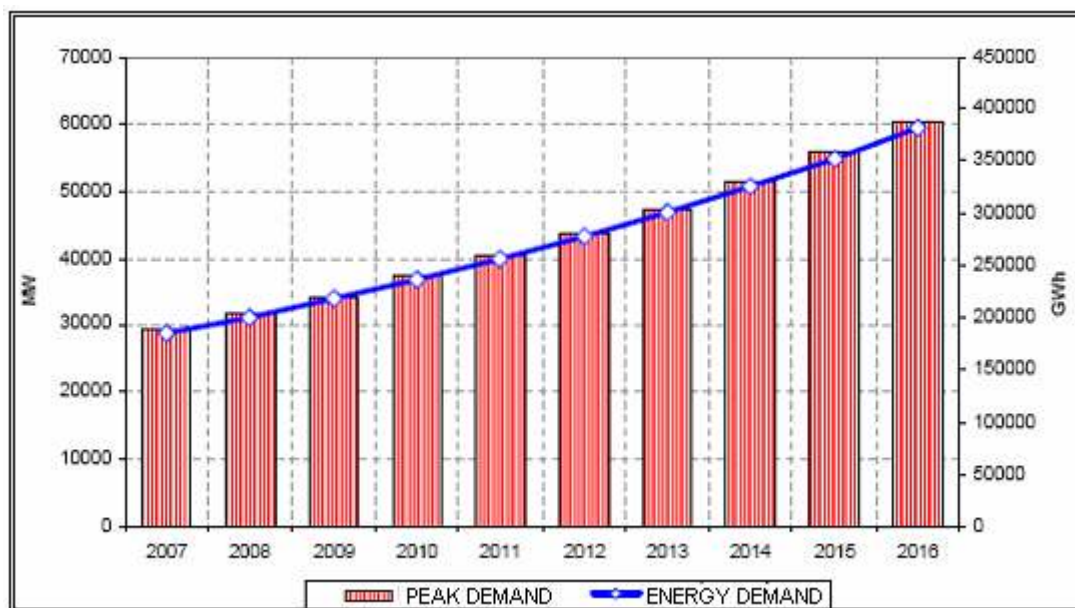
**Figure I-4.** Demand Forecast (Scenario 1, Adjusted High Scenario)

Figure I-5. Demand Forecast (Scenario 2, Adjusted Low Scenario)

YEAR	PEAK DEMAND		ENERGY DEMAND	
	MW	Increase (%)	GWh	Increase (%)
2007	29305	6.2	185032	6.2
2008	31151	6.3	196689	6.3
2009	33114	6.3	209081	6.3
2010	35200	6.3	222253	6.3
2011	37417	6.3	236255	6.3
2012	39775	6.3	251139	6.3
2013	42280	6.3	266961	6.3
2014	44944	6.3	283779	6.3
2015	47820	6.4	301941	6.4
2016	50929	6.5	321567	6.5

Source: Report of Turkey Long Period Electricity Energy Demand Study

The electricity demand that was 185,032 GWh according to the low scenario in 2007, is expected to be 321,567 GWh in 2016.

It is necessary to generate electricity that would meet the requirements of those kinds of activities in order that the country could realize industrial investments to the great extent. In this context, it is necessary to provide necessary energy infrastructure as well as meeting current consumption demand.

As it is stated in Turkish Electrical Energy 10-Year Generation Capacity Projection (2007-2016), the main purpose of the electricity policies is to supply cheap, reliable and qualified electrical energy to all consumers for the progress and social development of the country. For this purpose it is necessary to supply primary and secondary energy demand by utilizing all the domestic and imported energy resources and to mobilize all of the domestic and foreign, private and public investment/financing sources.

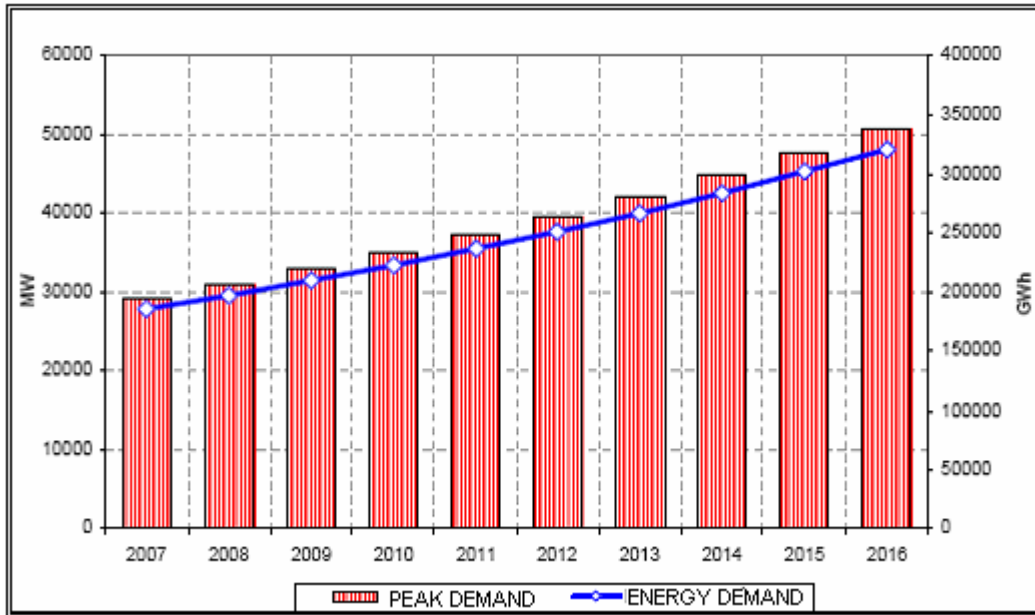


Figure I-6. Demand Forecast (Scenario 2, Adjusted Low Scenario)

In order to supply rapidly increasing energy demand and to increase quality and efficiency of electricity generation, it is necessary to establish power plants in industrialized regions of the country.

ENERJISA Energy Generation Inc. that considered the issues mentioned above, is planning to establish “Bandirma Natural Gas Combined Cycle Power Plant” (NGCCPP) with an installed capacity of 930.75 MWe in Balıkesir Province, Bandırma District, Sirincavus Village, Hacılibey Location. The Power Plant will be established on an area of 20 ha of a total 204 ha area. Total annual energy generation will be approximately 7.300.000.000 kWh. It is considered that the energy demand of the region will be supplied by the total annual energy generation within the Project to an important extent. In this regard, the Project is an important investment in terms of its purpose.

The ownership of the Project Site belongs to Kahramanmaraş Electricity Generation Inc. acquired 100 % by ENERJISA. The official letter designating this company as ENERJISA Energy Generation Inc. is presented in Appendix-1, and ownership certificate of the Project Site is presented in Appendix-2.

A license certificate for the Project was obtained from the Energy Market Regulatory Authority (EMRA) for 49 years (see Appendix-3).

It has been planning that the lifetime of Bandırma NGCCPP will be about 25 years.

II. LOCATION OF THE PROJECT SITE

II.1 Project Site Selection (Presentation of the Project Site approved by related Governorship or Municipality on an approved Environmental Master Plan scaled 1/25,000 (plan notes and provisions) and Zoning Plan in which the legend and plan notes are included, otherwise on map of existing land use if these plans are not available)

For the studies of location selection of proposed Bandirma NGCCPP, the distance of Project Site to the Marmara Sea is an important factor because water of Marmara Sea will be used as cooling water for the power plant. Additionally the fact that it is close to natural gas pipeline route is another important factor. Considering those two factors the following criteria have been taken into account in the studies of Project Site selection also:

- Position with respect to transportation system,
- Prevailing wind direction,
- Geological – seismic conditions,
- Topographical conditions,
- Situation of land ownership,
- Options for connection to the transmission system.

Project Site is 3.5 km away from Sirincavus as air distance, about 3.5 km away from Hidirkoy as air distance in the east, and about 5.5 km away from Bezirci Village as air distance in the southeast. Those residential areas are shown on “Topographical Map” given in Appendix 4. Additionally “Satellite Photo” showing the location of the Project Site is given in Appendix-5, location of the Project Site in Turkey and in Balikesir Province is given in Figure II-1 and “General Layout Plan” is presented in Appendix-6.

The study of Environmental Master Plan with 1/100,000 scale covering the Project Site is executed by the Balikesir Governorship (Province Special Administration) and approval process is continuing. In this context, it will be ensured the harmony between plan decisions with 1/100.000 scale not approved yet by the relevant administration and the plans to be prepared under sub-scale for the Project Site.

Planning studies will be evaluated by the relevant administration within the framework of the Law numbered 5302 by taking the views of relevant institutions and organizations.



Figure II-1. Location of the Project Site

II.2 Location of the Plant Facilities (Layout of all administrative, social, technical infrastructure units and other units of the Project, outdoor and indoor areas allocated for these units, flat numbers and heights of the buildings and their representative drawings)

Location of the plant facilities in the Project Site is presented in the general Layout Plan (see Appendix-6) and their indoor and outdoor area sizes, flat numbers and heights are presented in Table II-1.

Table II-1. Dimensions and the Flat Numbers of the Buildings

No	Building	Length (m)	Width (m)	Height (m)	Floor
1	Administrative and control building	65	20	12	2
2	Atelier and Store Building	50	25	12	-
3	Heat Recovery Steam Generator (2 units)	25	25	33	-
4	Pipe and Cable Canals	400	2	-	-
5	Turbine Building (GTG)	75	35	23	-
6	Turbine Building (STG)	65	30	29	-
7	Amplifier transformers (3 units)	20	20	8	-
8	Natural Gas Pressure Reducing Station	50	50	6	1
9	Security Building	10	10	3	1
10	Fire Service Station	10	10	-	-
11	Parking Lot Area	60	6	-	-
12	Switchyard	200	180	-	-

III. ECONOMIC AND SOCIAL ASPECTS OF THE PROJECT

III.1 Investment Program and Financial Resources of the Project

40 % of the investment will be provided from equity capital and foreign credit will be used for 60 %. Investment values and investment resources in the scope of the Project are given below.

All of the obligations within the Project such as development, design, constructions, operation and financing belong to ENERJISA.

The activities during the design, construction and operation phases the Project, will be carried out with the leading firms of the world and Turkey. The following considerations has been taken into account in the study of economic evaluation realized by ENERJISA for the Project.

Investment Period

Table III-1. The Rates to be used for Investment Period

Credit Rate	% 60
Equity Capital Rate	% 40
Credit Interest Rate	% 10,5
Duration of Investment	32 months

In order to optimize the structure of financing it will be used international resources during the development of the Project. Necessary funds to develop the Project will be provided by the investors of the Project as equity capital and by the banks as short and long-term credits. The structure of financing is as follows briefly:

- The ratio of credit/equity capital will be approximately 60%/40%.
- Project owners will procure necessary equity capital by themselves and do their best in Turkish financing environments aimed at their contribution.
- Aimed at procurement equipments and services it has been provided contacts with organizations whose abilities are generally accepted in the world.

It will be used credit for 60 % of total fixed investment. Credit interests, costs and operation capital will be supplied from equity capital for investment period. It has been planned that the cost of investment will be 600 million Dollars.

III.2 Workflow Diagram or Time Schedule of the Project

General time schedule related to realization of the project is presented in Appendix – 7. The details of the stages of time schedule is given below:

Feasibility Study

In the first stage of the Project it will be determined technical, economic and financial feasibility of the project.

- Preparation of the feasibility studies including preliminary project, environmental, economic and investment analyses,
- Submission of feasibility studies to MENR,
- Approval of feasibility studies by MENR.

Development

After the feasibility study is approved project-development stage will start.

- Concluding the agreement with relevant state organizations,
- Ground survey, current map, water survey and other site surveys,
- Concluding the agreements of engineering and prime contract,
- EIA process,
- Modifications of development plan (Cadastral modification),
- Obtaining guaranty and incentive certificates of the treasury,
- Finance procurement.

Constructions

The third stage will cover all of the establishing and construction activities until commercial operation of the facility.

- Detailed engineering,
- Purchasing,
- Construction and assembling,
- Tests and handover.

In this stage production licenses of the power plant will be obtained and will generate energy.

III.3 Cost-Benefit Analysis of the Project

Country/Region-wide Cost-Benefit Analysis of the Investment

The mentioned Project provides possibility of natural gas utilization that is imported input by procuring safe and qualified energy effectively and efficiently to an important degree.

Generally industrial and economic development of Turkey depends on supplying energy demand increasing fast indirectly. It is clear that the economic contributions to be added to production capacity of the country will serve to the interest of domestic industry.

Energy policy of Turkey is to provide safe and qualified energy for all users in order to support development of the country from the economic and social point of view timely. For that reason, it is expected to use all domestic and imported resources and to use all domestic-foreign, private-public investment and financing resources to meet primary and secondary energy demands of the users in secure and qualified manner.

Although it is given importance to domestic resources in production of energy, low quality and limitations of reserves increase the demand to qualified imported energy possibilities and share of those resources in total consumption in short and long terms. In this context, natural gas use instead of lignite and petroleum product will be made spread in energy and industrial sector in order to meet new energy demands. It evaluating the issues of energy production, transmission and transforming economically, it will be taken into consideration the environmental factors.

In Marmara Region, one of the most industrially developed and populated regions in Turkey, it is necessary to establish a new additional energy facility in order to meet electrical energy requirements of the region increasing fast.

It has been found suitable that this natural gas fired combined cycle power plant would be established within the border of Balıkesir Province because of either contributing to purposes of energy policy, electricity demands or increasing energy quality and production efficiency of domestic power plants or decreasing energy losses to the minimum level.

Cost-Benefit Analysis of the Project in terms of Investment

Operation Expenses

It has been planned that 175,000 m³/year natural gas will be used in the scope of the Project.

Operation Incomes

The electricity production of Bandirma NGCCPP is planned to be approximately 7,300,000,000 kWh.

Internal profitability rate of the Project is 12 %.

III.4 Other Economic, Social and Infrastructure Activities that are not in the Scope of the Project but Expected to be Performed by the Investor Company or Other Companies Throughout the Progress of the Project

Depending on realizing the mentioned Project, ENERJISA, the owner of the Project will ensure that the local people will be able to benefit the social facilities to be constructed for the personnel who will work in the power plant and their families.

III.5 Other Economic, Social and Infrastructural Activities which are not within the Project Scope but Required for the Implementation of the Project, and Expected to be Performed by the Investor Company or Other Companies.

During the construction and operation phases, it is expected that highway, service way, transmission line for the generated electricity and social facilities which are not within the Project scope, will be constructed, the commercial activities (opening pharmacy, market, shopping center etc) will increase and services of municipalities will develop. Thus indirect employment will have been provided.

III.6 Other Issues

There are no issues to be considered under this topic.

IV. DETERMINATION OF THE PROJECT IMPACT AREA AND EXPLANATION OF THE ENVIRONMENTAL CHARACTERISTICS OF THIS AREA

IV.1 Determination of the Project Impact Area, Demonstration of the Impact Area on a Map

It is necessary to evaluate the impacts of the Project in terms of environmental, economic and social aspects in order to specify the area to be impacted from the Project. Some of those impacts are direct while some of them are indirect and they are determined by taking into consideration the factors such as air quality modeling, flora, fauna, noise, employment, service, agriculture and forest areas, etc. of the Project impact area.

While the domestic and foreign locations will be affected from the Project positively in terms of supplying the electrical energy to the consumers, the local region particularly the Bandirma District will be affected positively in terms of socio-economic impacts.

Considering the stages of construction and operation for environmental impact area of the Project, the short and long term impacts of the Project are expected to occur. The impacts in the stage of site preparation and construction are temporary and for short time. Detailed information about those impacts and measures to be taken are presented in Section V.1.

The impacts such as dust, noise etc resulting from the activities to be carried out during site preparation and construction phases will be in short term and temporary. The environmental impact area was determined considering the emission modeling and noise calculations to be generated during the site preparation and construction phases. The radius of the impact area is 50 times of the stack height determined in accordance with Annex-4 of the "Regulation of Control of Air Pollution Originating from Industrial Establishments" (RCAPOIE). Within the Project, the maximum stack height is 40 m and impact area should have 2 km radius. This area is separated for receiving environment elements having 500 m x 500 m dimensions.

IV.2 Characteristics of the Physical and Biological Environment and Utilization of Natural Resources

Characteristics of physical and biological environment and utilization of natural resources are detailed in the following sections.

IV.2.1 Meteorological and Climatic Characteristics (General and regional climatic conditions, topography of the Project Site, monthly, seasonal and annual temperatures, precipitation, relative humidity, pressure and evaporation profiles and their graphics, number of inversion days, stability class, wind direction and velocity, annual and seasonal wind rose, number of stormy days, etc.)

General Climatic Conditions of the Region

In the region characteristics of Marmara (transition) climate is observed generally. Marmara climate has a transition characteristics between Black Sea, Mediterranean and Continental climates.

Summers are relatively cool in the coastal areas of Marmara Sea because of the effect of Black Sea climate. Towards to the internal parts the climate has characteristics of continental climate and the winters are relatively cold. Observation records of Bandirma Meteorological Station for 32 years and table of the maximum precipitation observed in standard times are presented in Appendix-8.

Distribution of Temperature

According to the data of Bandirma Meteorological Station, the annual average temperature of the region is 14.1 °C between 1975-2006, annual average maximum temperature is 18.4 °C, annual average minimum temperature is 10.0 °C. The maximum temperature observed is 42.4 °C measured on July 9, 2000. The minimum temperature is -14.0 °C measured on February 21, 1985. January is the coldest month with 5.3 °C and June and August are the hottest months with 23.6 °C.

Table IV-1. Long Term Average Monthly Temperatures (°C)

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average Temperature (°C)	5.3	5.4	7.6	12.1	16.6	21.4	23.6	23.6	20.0	15.6	10.5	7.1	14.1
Average Maximum Temperature (°C)	8.9	9.3	12.1	17.1	21.3	26.3	28.0	27.9	24.8	20.1	14.8	10.6	18.4
Average Minimum Temperature (°C)	2.1	2.1	3.8	7.5	11.7	16.0	19.1	19.6	15.5	11.7	6.8	3.9	10.0

Source: State Meteorological Service (SMS), Bandirma Meteorological Station (1975–2006)

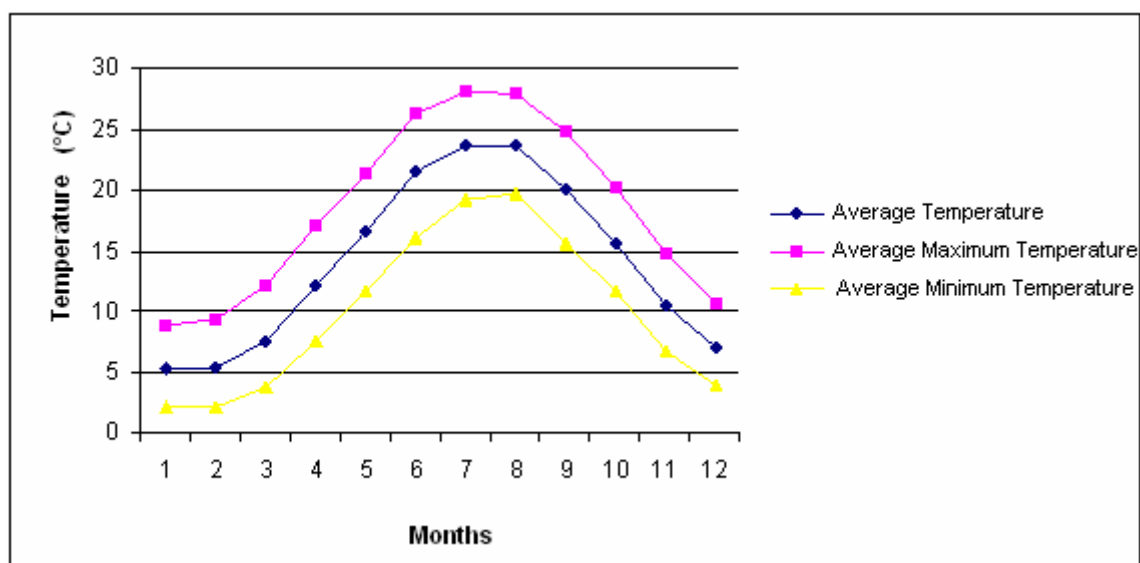


Figure IV-1. Long Term Average Monthly Temperatures (°C)

Distribution of Precipitation

According to the observation records of Bandirma Meteorological Station, total annual precipitation amount of the region is 703.7 mm, maximum monthly precipitation amount is 113.7 mm in December, and the minimum precipitation is 15.3 mm in August and the maximum daily precipitation amount is in October with 177.5 mm in 1975-2006.

Table IV-2. Long Term Average Monthly Precipitation (mm)

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average Total Precipitation (mm)	101.3	74.6	67.9	55.5	34.4	23.2	17.5	15.3	33.3	69.3	97.7	113.7	703.7
Daily Maximum Precipitation (mm)	81.5	58.3	46.6	46.7	37.9	60.7	71.8	103.3	61.1	177.5	92.9	86.1	177.5

Source: SMS, Bandirma Meteorological Station (1975–2006)

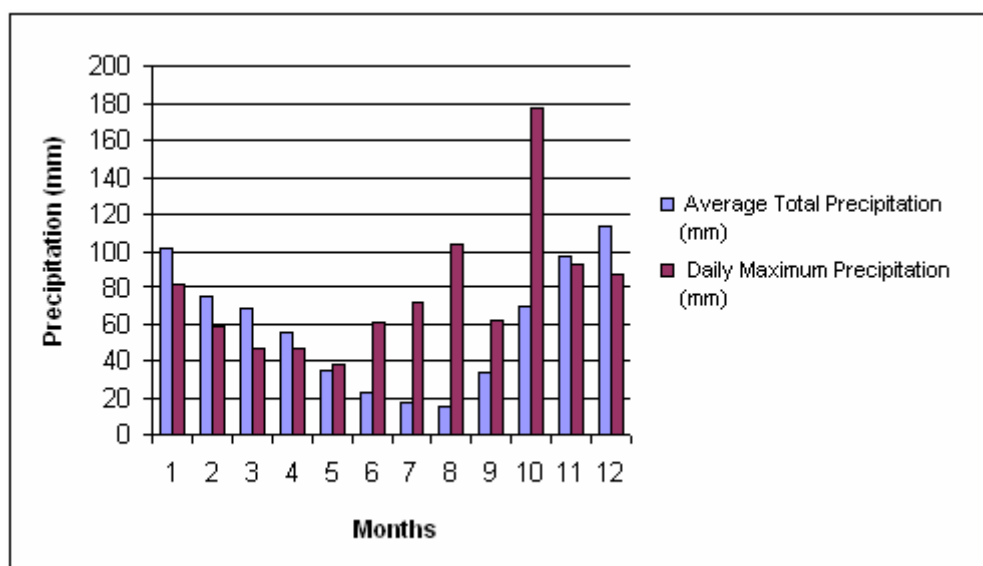


Figure IV-2. Long Term Average Monthly Precipitation (mm)

Distribution of Humidity

According to the observation records of Bandirma Meteorological Station between 1975-2006, annual average relative humidity is 71 %, maximum monthly average relative humidity is in January with 76 %, and minimum monthly average relative humidity is in July with 66 %. Minimum relative humidity is in March with 12 %.

Table IV-3. Long Term Average Monthly Relative Humidity (%)

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average Relative Humidity (%)	76	74	74	72	71	66	67	69	68	72	73	75	71
Minimum Relative Humidity (%)	26	23	12	18	14	16	14	19	13	14	19	19	12

Source: SMS, Bandirma Meteorological Station (1975–2006)

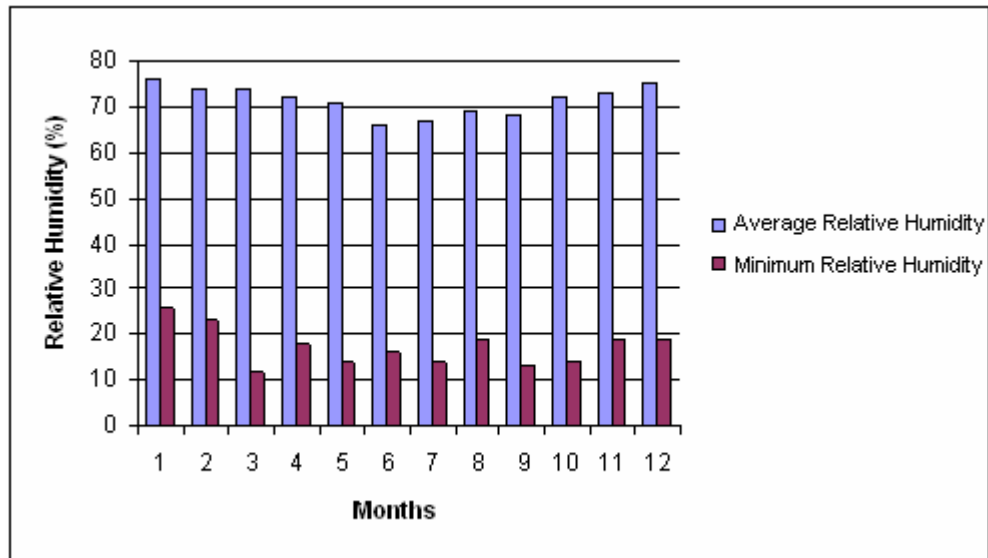


Figure IV-3. Long Term Average Monthly Relative Humidity (%)

Evaporation

According to the observation records of Bandirma Meteorological Station between 1975 - 2006, maximum monthly average evaporation occurs in July with 227.4 mm, and the maximum daily evaporation occurs in July with 14.0 mm.

Table IV-4. Long Term Average Monthly Evaporation (mm)

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average Evaporation (mm)			33.6	86.3	133.7	186.6	227.4	214.5	156.8	96.4	36.2	11.5	
Daily Maximum Evaporation (mm)	0.0	0.0	6.2	10.0	12.0	13.0	14.0	13.0	14.0	9.8	6.4	4.9	14.0

Source: SMS, Bandirma Meteorological Station (1975–2006)

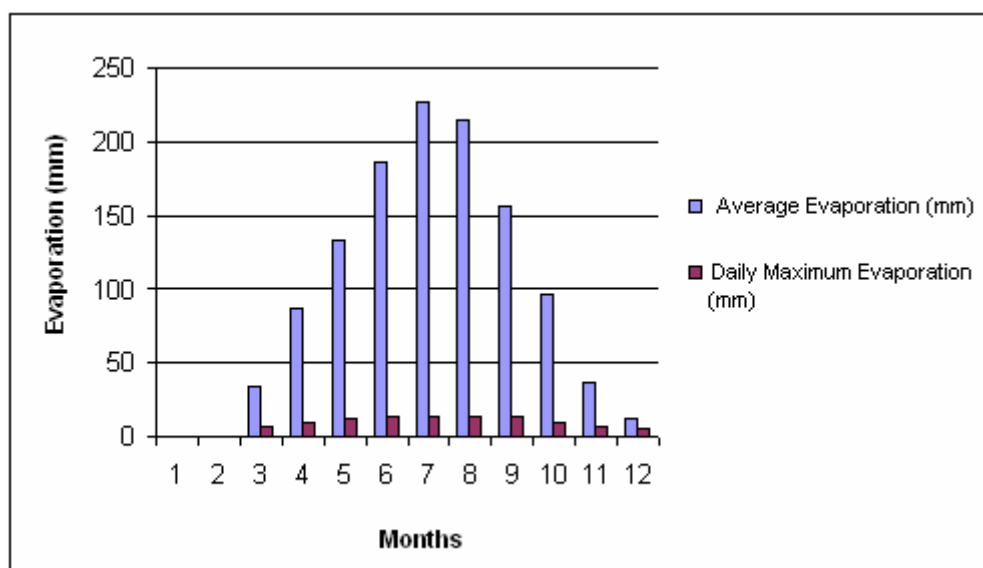


Figure IV-4. Long Term Average Monthly Evaporation (mm)

Distribution of the Logged Days (Number of days with fog, snowfall, snow cover, height of maximum snow cover)

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, annual number of days with snow cover is 6.8, maximum number of days with snow cover is in February as 3.2, the maximum thickness of snow cover is 33.3 cm in February, annual number of foggy days is 20.6, maximum average number of foggy days is 4.5 in November, average annual number of days with hail is 0.9, maximum average number of days with hail is in April with 0.2, annual average number of days with frost is 22.2, maximum average number of days with frost is 6.2 in January, average annual number of days with thunderstorm is 22.0, maximum average number of days with thunderstorm is 3.3 in June, and annual average snowy days is 15.3.

Table IV-5. Long Term Average Distribution of Logged Days

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average number of snowy days	4.3	5.0	2.7	0.1							0.5	2.7	15.3
Average number of days covered with snow	1.9	3.2	0.9	0.0								0.8	6.8
Maximum thickness of snow (cm)	14.0	33.0	28.0									14.0	33.0
Average number of foggy days	2.6	2.3	2.1	1.2	1.0	0.1	0.2	0.2	0.9	3.2	4.5	2.7	20.6
Average number of days with hail	0.1	0.1	0.1	0.2	0.1	0.1	0.0			0.1	0.1	0.1	0.9
Average number of days with frost	6.2	4.6	3.7	0.5						0.2	2.7	4.6	22.2
Average number of days with storm	0.9	0.9	1.1	2.4	2.4	3.3	1.9	2.1	1.8	2.3	1.6	1.3	22.0

Source: SMS, Bandirma Meteorological Station (1975–2006)

Average Soil Temperatures at the depth of 10 cm, 50 cm and 100 cm (Monthly, seasonal, annually, as graphic and in report text)

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, average and minimum soil temperatures of Balıkesir Province at the depths of 5, 10, 20, 50 and 100 cm are as follows.

Table IV-6. Average Soil Temperatures (°C)

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average 5 cm Soil Temperature (°C)	5.0	5.6	8.3	13.9	20.0	25.3	27.6	27.2	22.9	16.9	10.7	6.7	15.8
Min. 5 cm Soil Temperature(°C)	-0.1	-0.3	0.1	5.7	10.4	12.3	19.3	17.9	13.0	6.9	1.1	0.0	-0.3
Average 10 cm Soil Temperature(°C)	5.4	5.9	8.5	14.0	19.8	25.0	27.3	27.0	23.1	17.4	11.2	7.2	16.0
Min. 10cm Soil Temperature(°C)	0.5	0.2	0.9	6.3	10.2	14.0	20.3	19.1	14.3	8.1	2.8	0.9	0.2
Average 20 cm Soil Temperature(°C)	5.8	6.1	8.4	13.5	18.9	24.0	26.5	26.5	23.0	17.7	11.7	7.7	15.8
Min. 20 cm Soil Temperature(°C)	1.5	1.3	1.3	7.0	9.9	14.9	19.8	21.0	15.1	9.7	4.5	2.1	1.3
Average 50 cm Soil Temperature(°C)	7.1	6.9	8.5	12.6	17.3	22.0	24.9	25.4	23.0	18.7	13.3	9.3	15.8
Min. 50cm Soil Temperature(°C)	3.8	3.4	3.4	7.4	10.5	16.1	20.1	21.7	18.0	13.5	8.2	5.0	3.4
Average 100 cm Soil Temperature (°C)	8.8	8.0	8.6	11.6	15.3	19.3	22.3	23.5	22.4	19.4	15.1	11.4	15.5
Min. 100 cm Soil Temperature(°C)	6.2	5.5	0.7	8.0	11.0	15.2	19.2	21.4	19.5	15.5	11.0	7.8	0.7

Source: SMS, Bandirma Meteorological Station (1975–2006)

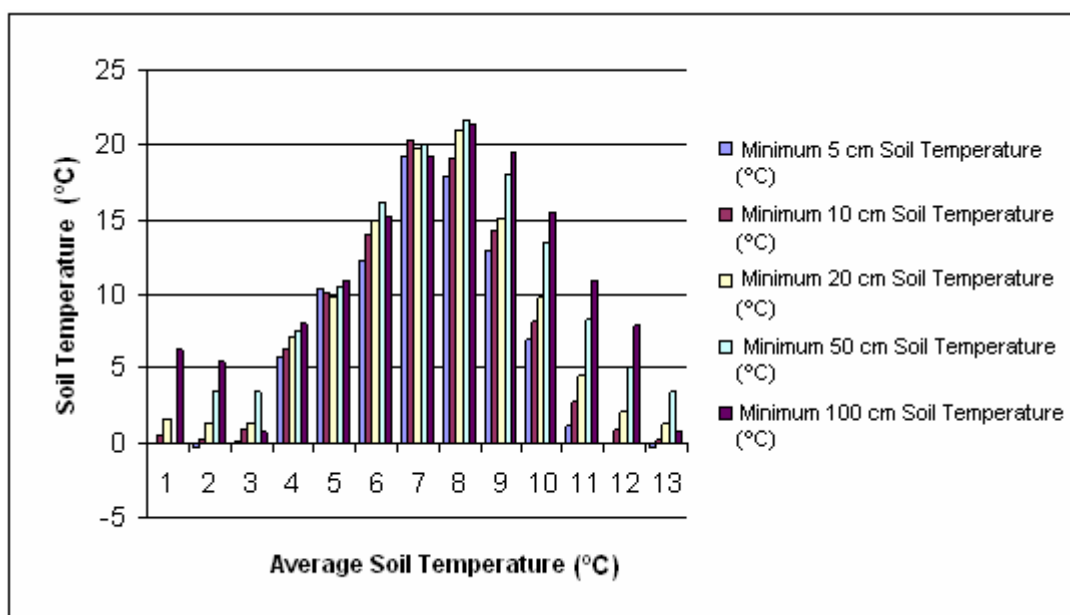


Figure IV-5. Average Soil Temperatures (°C)

Wind Distribution of the Region (Annual, Seasonal, Monthly Wind Directions, Wind Speed with respect to the Directions, Monthly Average Wind Speed Distribution and Graphic, Direction and Speed of the Fastest Wind, Number of Days with Storm and Strong Wind)

Direction and Speed of the Fastest Wind

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, The direction of the wind blowing with the highest speed is North and the speed of the fastest wind is 32.8 m/s observed in January.

Table IV-7. Direction and the Speed of the Fastest Wind

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
The direction of the fastest wind	N	NE	NNE	S	WSW	NNE	N	N	NE	NNE	NE	N	N
The speed of the fastest wind (m/s)	32,8	26,7	29,4	29,4	23,6	20,1	23,5	20,0	23,8	27,2	24,0	28,5	32,8

Source: SMS, Bandirma Meteorological Station (1975–2006)

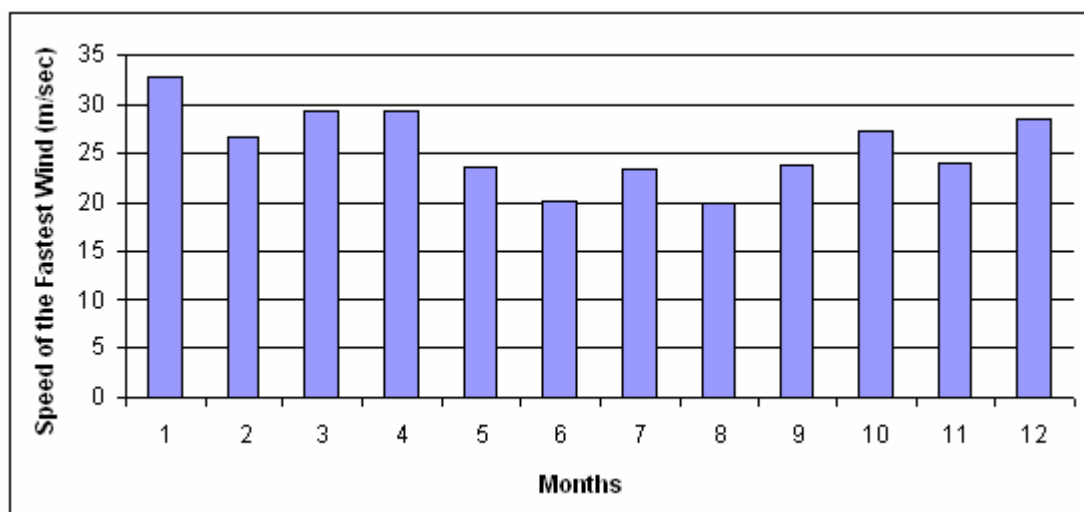


Figure IV-6. Speed of the Fastest Wind (m/sec)

Number of Days with Storm and Strong Wind

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, annual average number of days with storm of the region is 24.4. The highest number of days with storm is 3.5 days observed in December. Annual average number of days with strong wind of the region is 107.6 . The month with the highest number of days with strong wind is August with 13.2 days.

Table IV-8. Long Term Average Number of Days with Storm and Strong Wind

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average Number of Days with Storm (Wind Speed $\geq 17,2$ m/s)	3.3	3.4	2.6	1.1	1.4	0.6	1.3	1.2	1.6	2.3	2.1	3.5	24.4
Average Number of Days with Strong Wind (Wind Speed 10,8–17,1 m/s)	8.1	8.1	8.7	6.9	8.0	8.0	12.6	13.2	9.2	8.9	7.3	8.6	107.6

Source: SMS, Bandirma Meteorological Station (1975–2006)

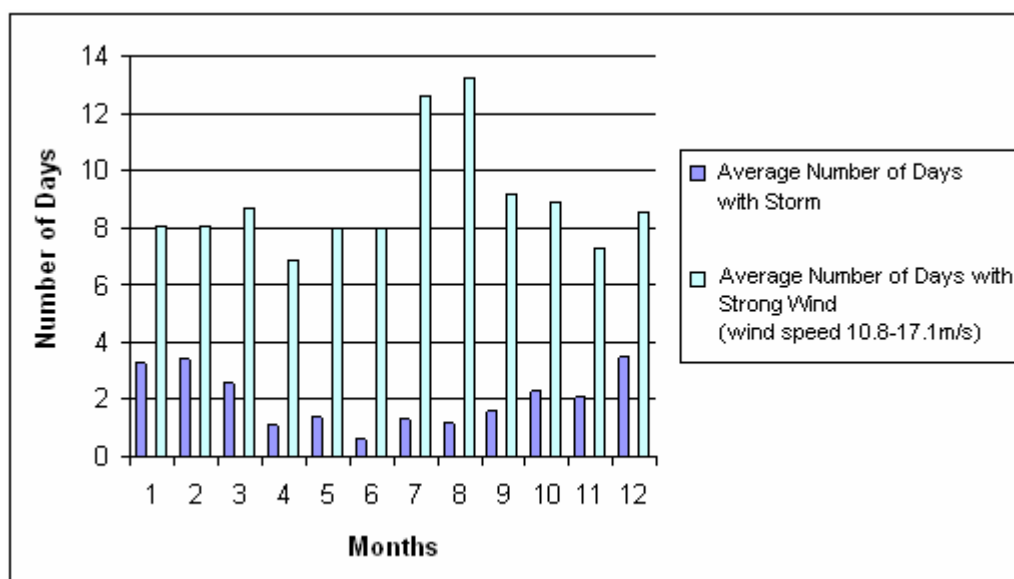


Figure IV-7. Long Term Average Number of Days with Storm and Strong Wind

Distribution of Annual, Seasonal, Monthly Wind Direction

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, annual average wind speed of the region is 4.0m m/s.

Table IV-9. Monthly Average Wind Speed

Months	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average wind speed (m/s)	4.0	4.3	4.0	3.2	3.4	3.6	4.7	4.9	4.2	4.2	3.5	4.0	4.0

Source: SMS, Bandirma Meteorological Station (1975–2006)

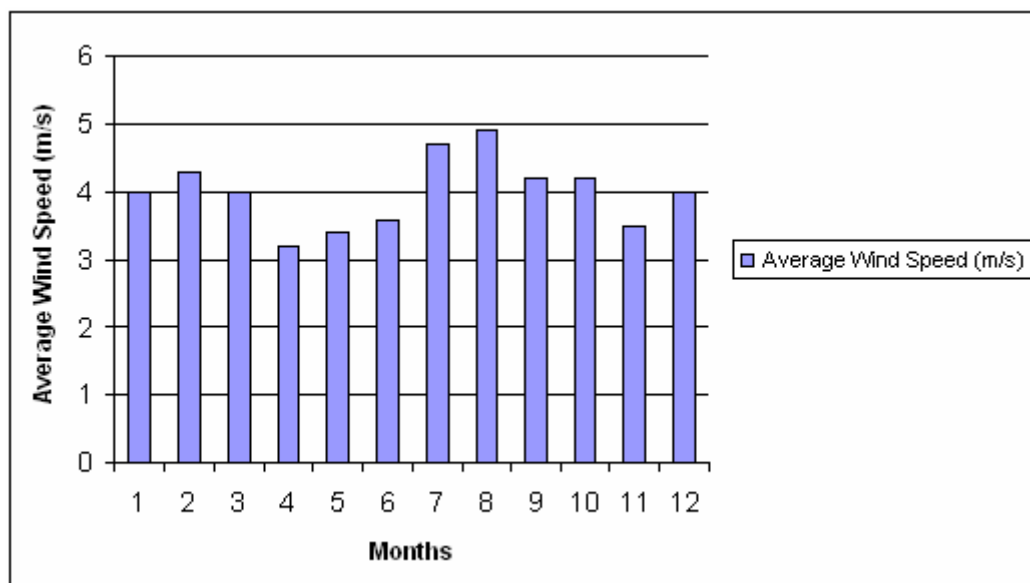


Figure IV-8. Monthly Average Wind Speed

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, total number of occurrences of wind by directions is given in the following table.

Table IV-10. Number of Occurrences of Wind

Direction	1	2	3	4	5	6	7	8	9	10	11	12	Annual
N	226	196	184	270	331	364	420	341	275	287	285	229	3408
NNE	642	576	723	587	788	783	1067	1163	780	764	488	565	8926
NE	513	603	644	492	558	655	844	911	835	679	501	488	7723
ENE	34	37	41	39	35	34	35	33	64	64	61	39	516
E	98	48	70	73	51	51	28	45	60	74	119	106	823
ESE	113	85	87	101	73	84	41	16	40	65	147	160	1012
SE	204	141	125	129	120	108	34	23	46	80	194	228	1432
SSE	200	172	117	99	83	52	16	17	41	67	164	217	1245
S	195	171	139	132	65	44	9	19	38	84	133	171	1200
SSW	57	60	64	62	40	20	7	6	23	26	52	44	461
SW	77	82	97	92	64	45	12	18	26	48	86	128	775
WSW	12	18	16	26	31	18	6	10	14	6	10	11	178
W	11	12	33	33	29	14	10	16	19	15	15	5	212
WNW	12	10	29	27	27	28	21	10	22	8	7	9	210
NW	15	43	75	125	116	92	49	32	44	77	43	38	749
NNW	74	62	97	126	171	152	140	102	154	142	85	74	1379

Source: SMS, Bandirma Meteorological Station (1975–2006)

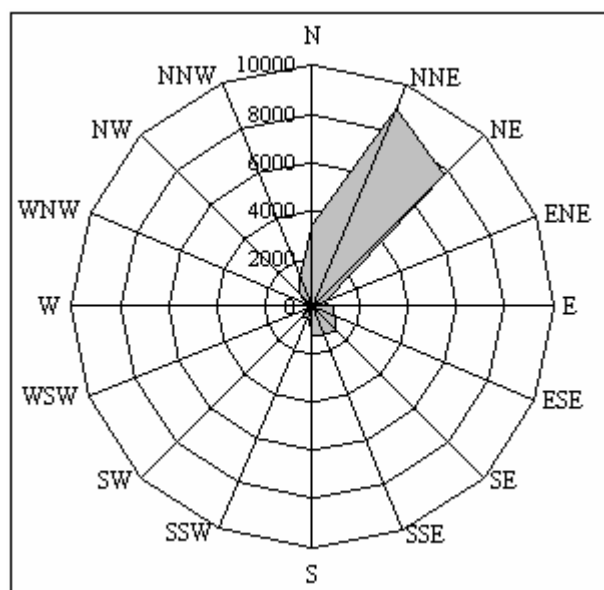


Figure IV-9. Annual Wind Rose by Number of Occurrences

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, the prevailing wind direction is NNE (north-northeast).

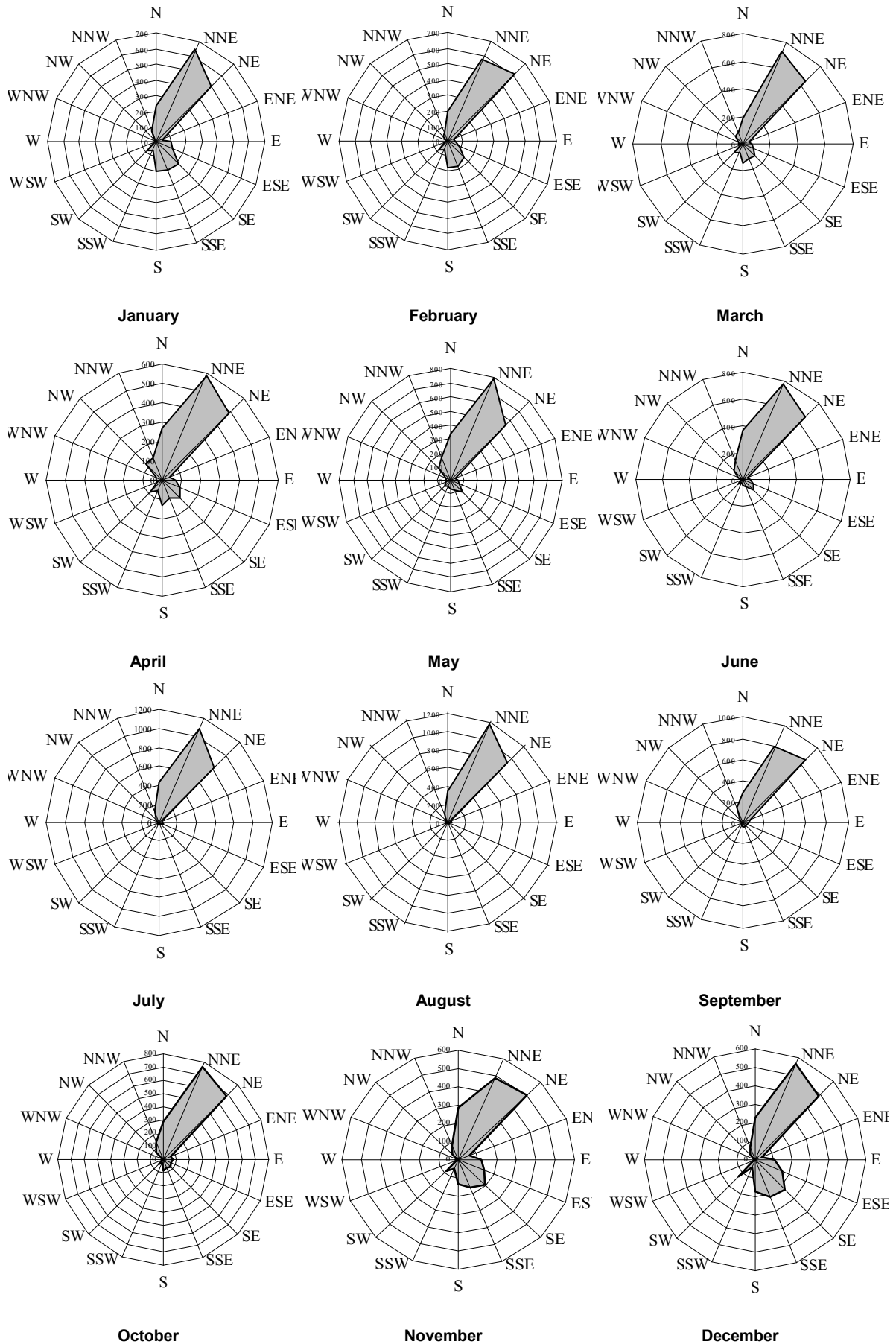
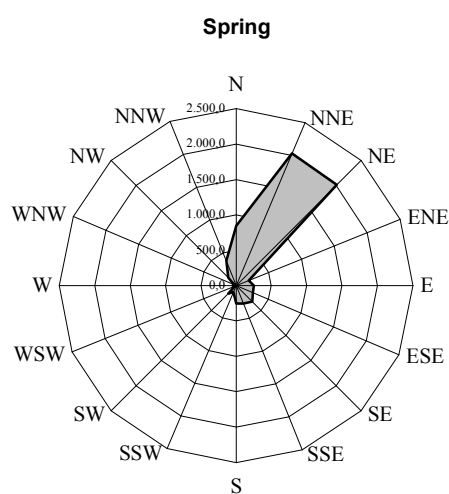
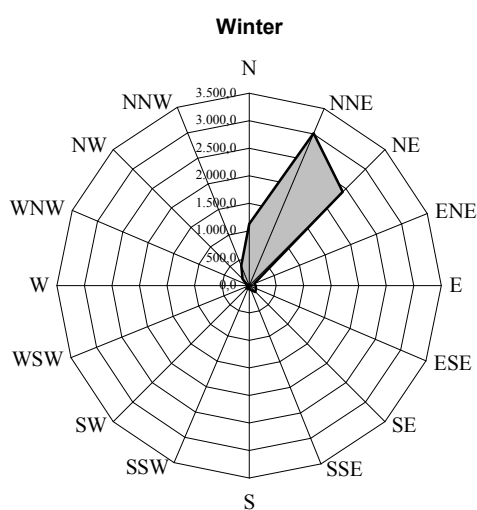
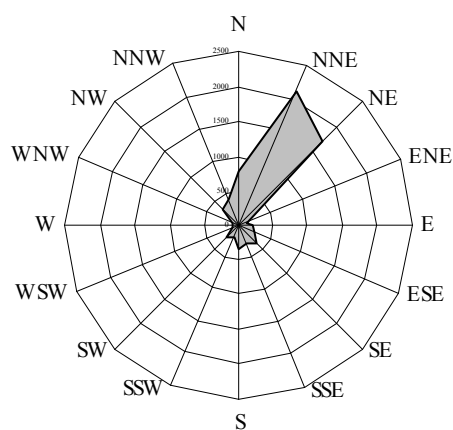
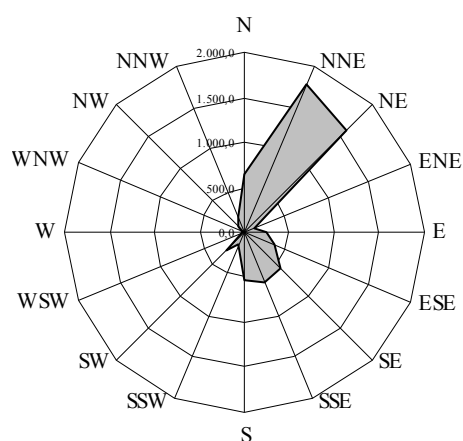


Figure IV-10. Monthly Wind Roses by Number of Occurrences

Table IV-11. Seasonal Number of Occurrences of Wind

Direction	Winter	Spring	Summer	Fall
N	651.0	785	1,125.0	847.0
NNE	1,783.0	2,098	3,013.0	2,032.0
NE	1,604.0	1.94	2,410.0	2,015.0
ENE	110.0	115	102.0	189.0
E	252.0	194	124.0	253.0
ESE	358.0	261	141.0	252.0
SE	573.0	374	165.0	320.0
SSE	589.0	299	85.0	272.0
S	537.0	336	72.0	255.0
SSW	161.0	166	33.0	101.0
SW	287.0	253	75.0	160.0
WSW	41.0	73	34.0	30.0
W	28.0	95	40.0	49.0
WNW	31.0	83	59.0	37.0
NW	96.0	316	173.0	164.0
NNW	210.0	394	394.0	381.0

**Figure IV-11.** Seasonal Wind Roses by Number of Occurrences

According to the observation records of Bandirma Meteorological Station between 1975 – 2006, average speed of the wind by directions are given in the following table.

Table IV-12. Average Wind Speed by Directions (m/s)

Direction	1	2	3	4	5	6	7	8	9	10	11	12	Annual
N	5.1	4.8	4.7	3.5	4.0	4.2	5.1	5.4	4.7	5.4	4.8	5.7	4.8
NNE	6.3	6.1	6.0	4.9	5.0	4.9	5.6	5.7	5.5	6.0	5.9	6.4	5.7
NE	6.6	7.0	6.0	5.0	4.7	4.9	5.5	5.9	5.7	6.1	5.7	6.3	5.8
ENE	1.4	1.9	1.5	1.3	1.5	1.6	1.5	1.3	1.5	1.8	1.4	1.6	1.6
E	1.8	1.8	1.8	1.8	1.7	1.7	1.6	1.4	1.3	1.3	1.6	1.8	1.7
ESE	2.0	2.1	2.0	1.9	1.8	1.7	1.3	1.5	1.6	1.7	2.0	2.2	1.9
SE	2.3	2.4	2.1	2.2	2.0	1.8	1.8	1.6	1.6	2.0	2.2	2.3	2.1
SSE	3.1	3.5	3.5	3.5	2.4	1.8	1.5	1.9	2.6	3.1	3.4	3.4	3.2
S	3.7	4.2	4.1	4.0	3.0	2.1	2.1	1.8	3.3	3.7	4.1	3.9	3.8
SSW	4.2	4.0	5.0	3.7	3.3	3.6	1.2	1.5	4.2	3.1	3.4	4.0	3.9
SW	4.0	4.1	3.7	3.9	3.3	2.8	2.2	2.4	3.2	3.4	3.3	4.2	3.7
WSW	1.7	3.7	2.3	2.2	2.4	2.0	3.9	2.4	1.6	2.3	2.0	2.4	2.4
W	3.5	2.2	2.4	2.7	2.6	1.8	2.0	2.4	2.2	2.5	1.8	2.8	2.4
WNW	5.6	2.0	2.1	2.5	2.3	2.5	2.2	1.5	1.7	1.0	2.1	1.8	2.3
NW	4.1	3.8	2.5	3.0	2.6	2.8	3.3	2.8	3.0	3.2	3.5	3.4	3.0
NNW	4.5	2.9	3.5	2.6	3.0	3.2	4.3	3.9	4.3	4.4	3.8	6.2	3.8

Source: SMS, Bandirma Meteorological Station (1975–2006)

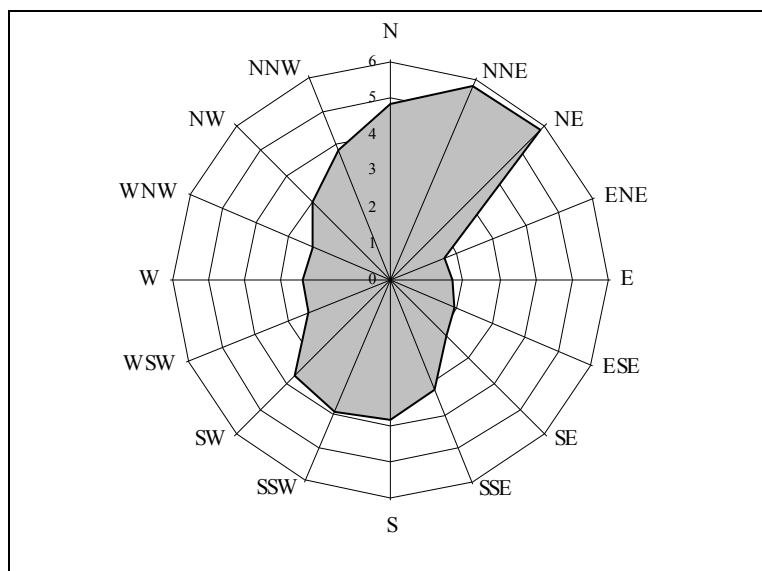


Figure IV-12. Annual Wind Rose by Average Wind Speed

IV.2.2 Geological Characteristics (Physico-chemical characteristics, tectonic movements, topographic characteristics, mineral resources, landslide, unique formations, geological map, geological sections, 1/25,000 and 1/5,000-scaled geological map, geological and geotechnical survey reports of the Project Site)

REGIONAL GEOLOGIC CHARACTERISTICS

Paleozoic Units

The base of Balıkesir Province and Kazdag (İda Mountain) massive going up 1,767 m and in northern part of Edremit from Biga peninsula are formed by Paleozoic or probably older migmatites. Gneiss in almandin amphibolite facie are on this base. Here green schist facie has very curls and is with fracture and shows horizontal and vertical transits. This layer found with marble layer together but at the upper level marble layer is dominant completely. Granite-granodiorites cutting those units are probably Paleozoic. Again because of contacts of granite and granodiorites with marble considerable amount of scarn zones were formed. Geologic map with 1/25.000 scale belonging to the Project Site and its legend are presented in Appendix-9.

There is a small metamorphic rock mostra surrounded by upper permian limestone that includes fusulinids at the junction of highway of Balya and Ivrindi cities 30 km at the west of Balıkesir Province. It is seen limestone and basalt conglomerate from the junction toward Ivrindi city. Here is one of the rare regions where the ages of conglomerate would be specified correctly.

A belt is lengthening along younger and lesser metamorphic series that is a part of Devonian formations (there are pre-permian fossils here) found in west, northwest and north parts of Menderes Massive and Karaburun Peninsula. This part is called *Upper Paleozoic Belt* and Kazdagi is on this part. In light with the existent information it could not correlated gneiss in Kazdagi and those that are found in Menderes massive with gneiss of the series in upper Paleozoic belt.

Balıkesir Province is represented by Fazlıkonagi with older Paleozoic that is spread stone unit between Manyas Graben and Marmara Sea. This unit consists of green schist and micaschists. It is encountered marble in form of lens and band from place to place in Fazlıkonak formation. Also it has been encountered serpentinites in some places in those schist. Marbles here are with gray-white sugar fiber and thin-middle layer. Toward upper level of Fazlıkonak formations it there are granite and granodiorite in narrow areas in the form of apophysis.

Mesozoic Units

Karakaya formation with Triyas age covers a very wide area in the region, and includes conglomerate, grit, mud stone and limestone blocks with permian age. It is observed different color changing from purple color to beige color in accordance with its Litology.

Tophisar Formation with middle-upper Triyas age consists of limestone with fractions. It is gray-beige color and with thin-middle layer. This formation ends with pudding stone, limestone with sand, crystallized limestone and limestone with thin dolomitic granules and micritic limestone from time to time from bottom part to upper part. Formation is on the other units in disharmony. Karakoca Formation with Liyas age consists of grit and limestone. It is observed beige and brick colors. Akcakoyun Formation with Dogger – Kretase age is represented by older limestone. It is clear beige and with middle-thick layers. It passes with solitic middle layer in the bottom and considerably hard micritic limestone that has silecit lump with cort band in the upper part from time to time.

Mesozoic Formations in North of Edremit Bay starts with a complex series with radiolarit and ofiyolit with sub Triyas age called Karakaya Formation and is covered by Cinarcik limestone with middle Tritas age and of this layer there is Hasanlar Formation belonging to Upper Triyas. Sub-Jura is represented by Terzialan grits and it is followed by upper jura and Alancik Formation with sub-Kretase age.

Cenozoic Units

Granite- granodiorite unit with Paleocene age is in macro crystalline fiber. Its edge zones have an appearance with foliation. Generally it is white and blackish dark green color and with white pied. It is observed quartz, microcline, biotite and little apatite in rock. It is the same age with Cataldag Granite cutting plateau mélange in north. Not separated volcano sediments are represented by Neocene units, pebble, grit, marn, limestone with clay, limestone, tuff, agglomerate and lava. Generally it is dirty white, dirty yellow, livid white, greenish white, whitish brown. Its base starts with pebbles and grits are not definite layered. They are loose and with tuff and calcite cement. Unit continues clay stone toward upper part and marn and turns into limestone. This order is observed as horizontal and vertical transit with tuff, agglomerate and andesite in all area. Neocene vulcanite consisting of andesite lava, agglomerate and tuff are with gray white, clear purple and pink color.

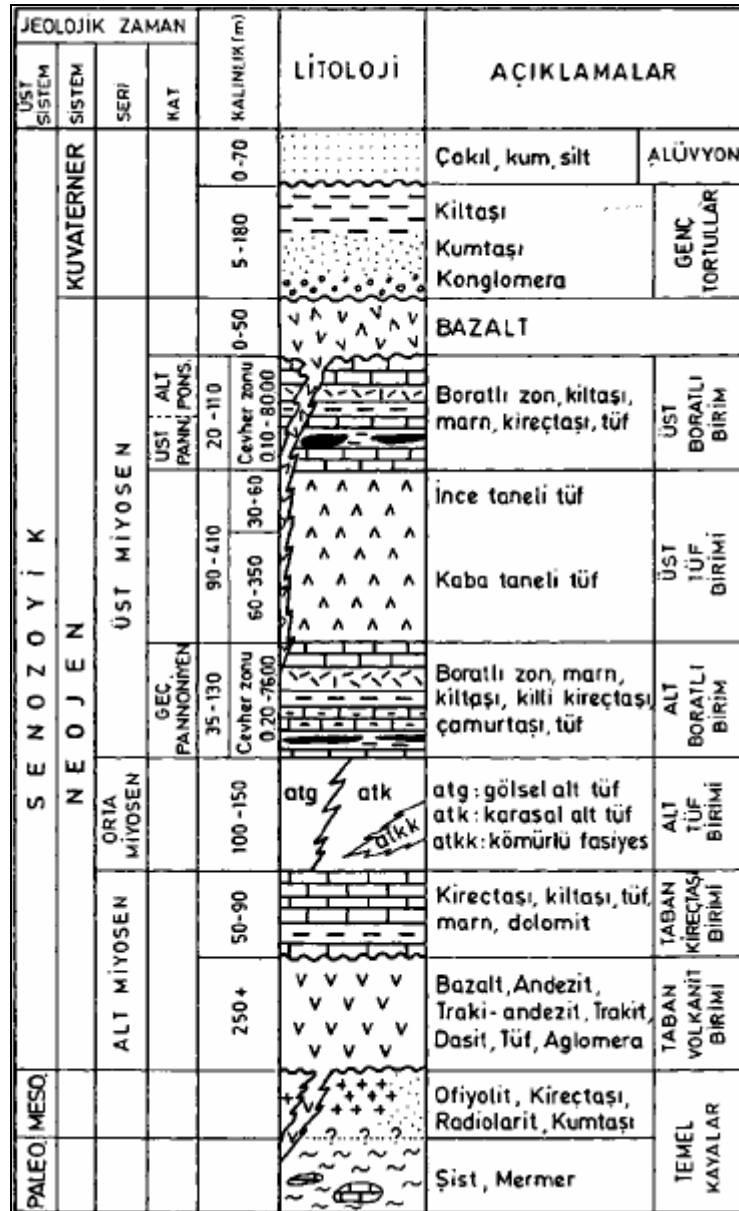


Figure IV-13. Anthropogenic Cross-section of Balıkesir Region

Myosin sediments consist of pebble, grit, marn, limestone silicified limestone and tuff, agglomerate and lava. They are red brown, yellowish, beige, dirty yellow. Pliocene sediments consist of pebbles, grits, tuffs and limestone. They are yellowish, dirty white, and dirty yellow. It includes vulcanite in the places that it comes vulcanite and lesser pebbles belonging to older units.

The upper Pliocene has a structure resembling dark brown and black layering consisting of older basalt lava. It has solid fiber, is cornered and curled and brittle. Sometime it can be also observed bigger feldspar visually. Basalt that is the latest product of volcano activity is the latest product of the region. Quaternaries are free pebble, sand and pebble depots forming in river valleys and plains. They are sediments under the river beds.

and found in the ore of massive. There are found in Gneiss-granites together and their ages are definite.

Kazak granodiorite plutonic was made metamorphosed by contacting with rocks with Paleozoic age. granodiorites gain porfirc character in edge zones. As to west side of intrazit mass there are rocks with thin granules that are dark green-gray and equals hornblend-diorite portine. Absolute age was determined as 79.8 ± 8 years in the age determination made with "total radiogenic lead method" of a granodiorite sample.

Tectonics and Paleogeography

Generally the fact that the heights are less and a wide area is covered by Neocene and younger units made harder to observe the structural events.

Tectonics

During placing Melanjin, it is observed big sariyage and faults with directed throw and adverse compression rooted faults. Additionally it is observed vertical faults formed during rising of younger tectonics. Most of those faults extend with KD-GB. Vertical faults in region are as follows: at the south of Samli–Armutalan Ilicayolu and in Ciftlik Dere it is with K15B extension, at the west of Samli it is with DB extension, at the north of Yenikoy it is with K15B extension, at the west of Ayvatlar in Koteyli Dere it is with K6B extension and additionally in the are where Manyas and Apolyont lakes are it is with DB extension graben, at the north and northeast of Yaylabasi village it is with K65B extension, at Dursunbey Station forming Tekeredere Valley it is with K35B extension, between Dalkoy – Buyukkatranci it is with K55D extension faults.

Additionally graben faults are spread along Edremit Bay. In vertical faults south of Karakoca is with K40D extension in Karakoca River, it is with K67 D extension at the west of Hasanlar village in Goktastepe with right throw, it is K30D extension at the4 east of Yoganoluk in Sarikaya Sirti.

Studying Area - Geologic Characteristics

In the studying area it was opened 110 researching holes and 6 drilling wells in 25 m- depth and 34 drilling wells in 18 m-depth. The levels obtained in researching holes and drilling wells are given in Geological and Geotechnical Survey Report with local development plan purpose prepared Jeoaktif Limited Company (see Appendix-10).

It was observed that studying area consisted of clays with sand and pebble belonging to Neocene series. The levels past in researching holes are as follows:

GEOTECHNICAL EVALUATION

SPT Experiment Results:

SPT (Standard Penetration Test) was made in every 1.5 m in ground drilling opened in parcel to specify rigidity and density characteristics. SPT results made in 40 drilling wells are given in Geologic and Geotechnical Survey Report (Appendix-10). It was determined that SPT-N made in 3.00 m and 6.45 m depths in 40 drilling wells changes between 26 and 42.

The connection between shock number obtained from SPT and unconfined compressive strength is as follows:

Shock Number (N)	Density	Unconfined Compressive Strength q_a (Kg/cm ²)
2 >	Very soft	0.25 >
2 – 4	Soft	0.25 – 0.50
4 – 8	Middle	0.50 – 1.00
8 – 15	Hard (Rigid)	1.00 – 2.00
15 – 30	Very Hard (Very Rigid)	2.00 – 4.00
30 <	Hardest	4.00 <

In accordance with the table correlation between shock number obtained from SPT experiment made in ground drilling in parcel and unconfined compressive strength was specified as follows. It was determined that SPT-N (II+III) made in 3.00 m and 6.45 m depths in 40 drilling wells changes between 26 and 42.

Comparisons between results of SPT made in 40 drilling wells and unconfined compressive strength are given in Geological and Geotechnical Survey Report (Appendix-10).

Determination of Mechanical Characteristics of Soil

Terzaghi formula was used to determine the mechanical characteristics of the soil.

Terzaghi's Formula is as follows:

$$q_d = K_1 c N_c + \gamma_1 D_f N_q + K_2 N_y B \gamma_2$$

K_1 and K_2 = Coefficient depending on the form of primary base.

C=Cohesion

ϕ =Angle of shearing resistance

D_f =Depth of base

γ_1 =Unit volume weight of the soil on primary base

γ_z = Unit volume weight of the soil under primary base

N_y, N_q, N_c = Bearing capacity coefficients of the soil under the primary base depending on angle of shearing resistance

Table IV-13. K_1 and K_2 Values

Base Form	k 1	k 2
Belt	1	0.5
Square	1.2	0.4
Circle	1.3	0.3
Rectangular	$1 + (0.2B/L)$	$0.5 - (0.1B/L)$

Table IV-14. Bearing Capacity Coefficients (Terzaghi)

Degree	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
N_c	5.7	6.2	6.7	7.5	8.6	9.6	11	12.3	13.8	15.6	17.6	20.4	23.6	27.2	31.2	37.2	44	52.5	64	80	96
N_q	1	1.2	1.5	1.8	2.3	2.7	3.3	4	4.9	6.1	7.4	9.2	11.4	14	17	23	28	36	47	64	82
N_y	0	0.2	0.4	0.7	0.9	1.2	1.7	2.2	2.9	3.8	5	6.5	8.5	11	15.5	20	27	36	51	74	101

Studying of Expansion and Liquefaction Potential

Comparisons between results of SPT made in 40 drilling wells and unconfined compressive strength are given in Geological and Geotechnical Survey Report (Appendix-10).

It was made experiments and studies such as cohesion, liquid limit, water content, granule unit volume weight, sieve analysis on samples taken from 40 drilling wells. Results of the mentioned experiments and studies are given in Geological and Geotechnical Survey Report (Appendix-10).

Evaluation of Settlement and Expansion Potential:

When taking into consideration allowable bearing stress of soil that is $q = 1,78 \text{ kg/cm}^2$, vertical stress of the soil under this pressure was calculated as follows:

$$q_o = q_{em} - \gamma \times D_f$$

$$q_o = 17,8 - 6,98 = 10,82 \text{ t/m}^2 = 1,082 \text{ Kg/cm}^2$$

This value is the result obtained in accordance with the allowable bearing stress of soil.

When the thickness of compressible layer under base is taken as $H=3$, settlement amount of this layer was calculated as follows assuming that the impermeable layer continues under the base.

For the calculations, the value $q_o = 1,082 \text{ Kg/cm}^2$ calculated according to the allowable bearing stress of soil is taken into consideration. In accordance with the consolidation test results, the value $m_v = 0,0058 \text{ m}^2/\text{kg}$ is calculated.

$$\Delta h = m_v \times q_o \times H = 0.0078 \times 1,082 \times 300 = 2,53 \text{ cm.}$$

When the thickness of compressible layer under base is taken as $H=3$, the time period needed for 50 % of the settlement to occur, was calculated as follows according to the Consolidation Theory.

$$T_v = c_v \times t_{50} / H^2$$

$$c_v = 0.017 \text{ cm}^2 / \text{minute for } U = \% 50;$$

$$\text{taking } T_v = 0.197 \quad 0.197 = 0.017 \times \frac{t_{90}}{H^2}$$

$t_{90} = (0,197 \times 3002) / 0,017 = 1.042.941 \text{ minutes} = 724 \text{ days.}$ 50 % of the total settlement is completed in 724 days.

Calculations of settlement -expansion potential of 40 drilling wells opened in the Project Site are given in Geological and Geotechnical Survey Report (see Appendix-10) in details.

NATURAL DISASTER AND EARTQUAKE

Natural Disaster

There is no risk for any disaster mentioned in the Law numbered 7269 (see Appendix-10 Geological and Geotechnical Survey Report)

Earthquake

It is not observed any fault and discontinuity that cross the parcel. But Manyas Active Fault crosses at the north of survey area. Moreover survey area is under the effect of Yenice-Gonen and Sarikoy Active Faults at the northwest. For that reason this matter should be taken into consideration while preparing static and reinforced concrete projects related to the facility. Not scaled active fault map where the location of the Project is presented in Appendix-11.

Manyas Fault: The fault is 60 km long and lengthens in east-west direction. It is right side strike-slip fault and caused an earthquake of magnitude 7 on October 6, 1964. In the future it may cause an earthquake of magnitude 7.0-7.4.

Edincik Fault: The fault is approximately 30-35 km long and lengthens in northeast-southwest direction. It is right side strike-slip fault and caused an earthquake of magnitude 6.4 on January 4, 1935. In the future it may cause an earthquake of magnitude 6.0-6.5.

Yenice–Gonen Fault: The fault is approximately 55 km long and lengthens in the northeast-southwest direction. It caused an earthquake of magnitude 7.2 on March 18, 1953. In the future it may cause an earthquake of magnitude 7.0-7.4.

Sarikoy Fault: The fault is approximately 60 km long and lengthens in northeast-southwest direction. It is right side strike-slip fault and may cause an earthquake of magnitude 7.2-7.5.

The list presenting the earthquakes observed in Balıkesir and its vicinity in 1881 – 1986 is given in Geological and Geotechnical Survey Report. Because the Project Site is in earthquake zone degree I, Effective Ground Acceleration Coefficient, A_0 is 0.40 g.

According to the Earthquake Zoning Map prepared by the Ministry of Public Works and Settlement of Republic of Turkey became effective with the decision of the Cabinet, numbered 96/8109 and dated April 18, 1996, Bandırma District where the Project Site lies is in the 1st Degree Earthquake Zone. Earthquake Map of Balıkesir Province is presented in Figure IV-15.

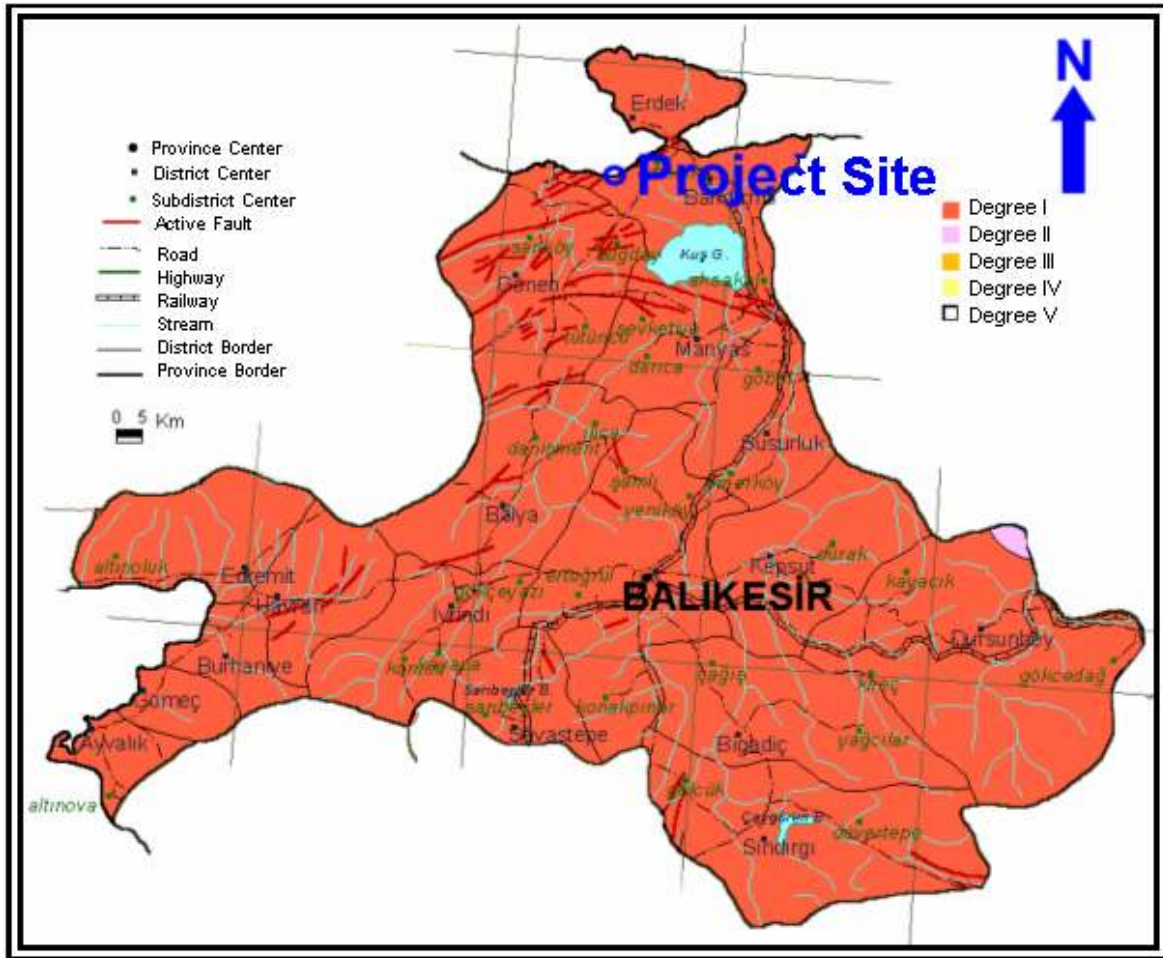


Figure IV-15. Earthquake Map (www.deprem.gov.tr)

Because it has been planned to construct buildings such as offices, social and administrative facilities, survey reports were prepared and submitted for approval to the authority in order to be evaluated in line with the circular of General Directorate of Disaster Affairs numbered 4256 and dated April 4, 2003. This report is the bases for the plan to be prepared in accordance with the report format that is an annex of circular of the General Directorate of Disaster Affairs numbered 4343 and dated May 31, 1989 for those areas.

The provisions of the Regulation on Buildings to be Constructed in Disaster Zones issued in the Official Gazette dated September 2, 1997 and numbered 23098 and the provisions of the Regulation about Buildings to be Constructed in Seismic Zones issued in the Official Gazette dated March 6, 2007 and numbered 26454 will be strictly complied with.

IV.2.3 Hydrogeological Characteristics (Groundwater levels, safe discharge values of any kind of sink shaft, deep well, artesian well, etc., physical and chemical characteristics of water, current and planned usage of groundwater)

Use of Water Resources

Groundwater is used for irrigation purposes in Balıkesir Province. Groundwater resources are presented in Table IV-15.

Groundwater Resources

Table IV-15. Groundwater Resources used for Irrigation Purposes in Balıkesir Province

Name of the Facility	Year when it was opened for operation	Irrigation Area	
		Gross (ha.)	Net (ha.)
Balıkesir-Edremit Center 1 st section	1976	625	586
Balıkesir-Edremit Center 2 nd section	1976	200	188
Balıkesir-Edremit Center 3 rd section	1978	825	776
Balıkesir-Edremit Center 4 th section	1997	500	470
Balıkesir-Havran Center	1972	1500	1410
Balıkesir-Havran- Buyukdere and Kucukdere	1990	300	282

There are 19 groundwater reserves determined by State Hydraulic Works (SHW) XXV. Regional Directorate within the borders of Balıkesir Province. (see Table IV-16)

Table IV-16. Groundwater Reserves of Balıkesir Province and Purpose of Use

No	Name of the Reserve	Purpose of Use
1	Balıkesir	Potable, irrigation
2	Pamukcu	Potable
3	Kepsut	Potable
4	Dursunbey	Potable, irrigation
5	Savastepe	Potable
6	Ivrindi	Potable
7	Gokceyazi	Potable
8	Balya-Ilica	-
9	Edremit-Burhaniye-Havran	Potable
10	Gomec (Armutova)	Irrigation
11	Altinova	Potable
12	Ayvalik	Potable, irrigation
13	Gonen-Sarikoy	Potable, irrigation
14	Tahirova	Irrigation
15	Manyas-Bandirma-Susurluk	Potable, irrigation
16	Erdek	Potable
17	Sindirgi	Potable
18	Bigadic	Potable
19	Marmara Adasi	Potable

Table IV-17 presents information about drainage areas and safe discharge values of groundwater reserves determined during research carried out by SHW XXV. Regional Directorate in Balıkesir Province.

Table IV-17. Drainage Areas and Safe Discharge Values of Groundwater Reserves in Balıkesir Province

	Name of Reserve	Drainage Area (km ²)	Safe Discharge (hm ³ /year)
1	Balıkesir	1282	38.8
2	Pamukcu	372	
3	Kepsut	2073	9.4
4	Dursunbey	1640	0.075
5	Savastepe	307	3.353
6	Ivrindi	747	0.041(negative)
7	Gokceyazi	175	1.26
8	Balya-Ilica	995	-
9	Edremit-Burhaniye-Havran	1407	80
10	Gomec (Armutova)	153	4.5
11	Altınova	570	16.4
12	Ayvalık	95	8.86(negative)
13	Gonen-Sarikoy	875	29.12
14	Tahirova	123	4.5
15	Manyas-Bandırma-Susurluk	2062	39.015
16	Erdek	325	0.7
18	Bigadic	1423	22
19	Marmara Island	103	0.665

For Bandırma NGCCPP Project, main water demands during the process are boiler feedwater and cooling water. Cooling water will be supplied from the sea. Boiler feedwater which is required less than cooling water will be also supplied from Marmara Sea with a desalination process. .

In case that groundwater is used, the necessary applications will be made and the necessary permissions will be obtained from SHW XXV. Regional Directorate in accordance with the Groundwater Law numbered 167.

Characteristics of Marine Environment

Marmara Sea

It is an inland sea with an area of 113.52 km² and lies in the east-west direction. Its long axis is 278 km long and its short axis is 76 km long. Marmara Sea continues with narrow and deep bays such as İzmit and Gemlik Bays toward Eastern direction. There are Erdek and Bandırma Bays in both sides of Kapedag Peninsula in southern coast. Northern coast is less indented than southern coast and includes typical bays. There are Tekirdag and Silivri recesses separated by Marmara Eregli recess and Buyukcekmece Bay.

Depth of more than half of Marmara Sea is about 200 m. There are three holes whose depths exceed 1.000 m in the valley lying in the east-west direction that is close to

North of the sea. West hole is 1,112 m deep in front of Tekirdag, middle hole is 1,220 m deep in front of Silivri, and east hole is 1,238 m deep at north of Armutalan Peninsula.

Marmara Sea is affected by the currents formed by level and density differences between Black Sea and Aegean Sea. There is a surface current running from Black Sea to Aegean Sea and a deep current running from Aegean Sea to Black Sea. Surface current coming from Black Sea spreads as a spectrum in Marmara Sea while leaving Istanbul Strait and collects again while entering into Canakkale Strait.

The speed of those currents changes between 0,75-2,5 km/s. Wind speed and direction are effective in the speed of the currents.

IV.2.4 Soil Characteristics and Utilization Conditions (Soil structure, land use capability classification, carrying capacity, slope stability, erosion, grassland and use of land for agricultural purposes, etc.)

General Soil Structure

Different soil types are present in Balıkesir Province formed under the effects of bedrock, climate, vegetation and human being. Erosion in Balıkesir Province and the slopes of Kaz Mountain, Alacam Mountain and Ulus Mountain that show character of plateau entirely disrupted by the valleys from time to time has continued in depressions of sedimentation in the vicinity. For that reason soil layers have gradually developed or not formed in the soil cover in most places of Balıkesir Province.

Zonal soils showing distribution in Balıkesir Province are in four groups. Limeless brown forest soils are the most spreading soils. Those soils encountered on metamorphic schist, granite with mélangé series, and granodiorite and volcanic rocks are covered by dense forests mostly.

Brown forest soils without lime can be observed in places where the flora has been destroyed and in the areas not including limestone within Balıkesir Province. Generally the soils developing on bedrock such as micaschist, gneiss, phyllite and crystallized limestone are brown forest soils. They are seen in Edremit Bay and in the vicinity of Dursunbey.

Generally reddish brown Mediterranean Sea soils have developed on the rocks such as limestone and rock with limestone in spreading area of maki-garig and red pine vegetation characterizing landscape characteristics of Mediterranean Sea Climate Conditions.

However, there are introzonal and azonal soils in two groups in Balıkesir Province. Out of the particular soil types there are stony place, rocky place, sandy place and hydromorphic alluvial soils in the places where groundwater is close to the surface, and coast marshy areas in lagunar environments.

Assessments made in accordance with average analysis results belonging to Balıkesir Province soils and averages in the groups is as follows:

Soil structure

Soil structure is the most important factor for nutrients, the water necessary for growing the plant, ventilation and water permeability. Soil classification of Balıkesir Province carried out according to the saturation percent reveals that 2.4 % is sand, 45.9 % is tin, 45.9 % is clayed tin and 5.4 % is clay. This distribution shows that Balıkesir Province has soil structure convenient for agriculture.

Soil Reaction

Soil reaction defines the suitability of the soil for living organisms. in Balıkesir Province 18 % of the agricultural soils have acidic (whose pH is less than 6.5), 55,8 % neutral (pH 6.6-7.5), 26,2 % alkali (whose pH is more than 7.5) reaction.

Soil Salinity

Soil salinity is a factor negatively affecting growing the plants and consequently efficiency of the soil. Sensitivity of every plant is different against salinity. In Balıkesir Province, 98.7 % of the agricultural soil is without salt, 1.2 % of the agricultural soil is slightly salty and 0.1 % of the agricultural soils are moderate level salty and salty.

Soil lime

Lime in the soil makes positive effect of yield by increasing benefit rate from used in vegetal food substances and from commercial fertilizers by changing pH as well as its positive effect on physical characteristics of soil. 64.8 % of soils include limited lime, 11.3 % of soils include moderate lime and 3.2 % of soils include high amount of lime in Balıkesir Province.

Organic Matter and Nitrogen

Organic matter is a material occurring by falling waste of plants and animals in the soil to pieces. While correcting the physical characteristic of the soil also the plant food substances in its composition become profitable. Additionally it is provided that the water and food substances are maintained by the soil. The resource of nitrogen in soil is organic substance.

Most part of the agricultural soils of Balıkesir Province is poor in terms of organic matter. In accordance with the results of analysis 13.4 % of the soils has very small amount of organic matter, 49.3 % of the soils has small amount of organic matter, 27.3 % of the soils has organic substance in moderate level, 7.57 % of the soils has large amount

of organic matter, and 2.5 % of the soils has organic substance in high level. It is necessary to fertilize the soil with fertilizer that includes nitrogen and to take measures to increase amount of organic substance for continuity and increasing.

Phosphorus in the Soil

Phosphorus is one the most important nutrient necessary to be found in the soils. It is effective for growing the plant, yield and quality. It can be taken by the plants. For phosphorus determination in accordance with "Olsen Method", it was determined that 42.3 % of the soils includes phosphorus, 19.6 % of the soils includes phosphorus in middle level, 11.3 % of the soils includes phosphorus in high level, and 26.8 % of the soils includes phosphorus in very high level in Balıkesir Province. In accordance with those evaluations it is necessary to reinforce those soils with fertilizers with phosphorus.

Potassium in the Soil

Potassium is an important nutrient for growing and reproducing the plant affects on yield and quality and causes increase the rate of fat, starch and sugar of the fruits. Because of geological structure and climate in our country potassium accumulates a lot in the soils. Less than 5 % of the soils includes potassium in little level, 8.7 % of the soils includes potassium in middle level, 13.7 % of the soils includes potassium in sufficient level and 73.1 % of the soils includes potassium in high level in Balıkesir Province. As it is seen although potassium level of soils of Balıkesir Province is sufficient it is required little fertilizer with potassium.

Table IV-18. Measurements and Standards of Soil Analyses

KIND OF ANALYSIS	METHOD OF ANALYSIS	STANDARD MEASUREMENT	MEANING
Soil Structure	Structure According to % Saturation	0-30	Sand
		30-50	Tin
		50-70	Clayed Tin
		70-110	Clay
		110+	Heavy Clay
Soil Reaction	PH in the Saturation Sludge (With glass electrode)	-4,5	Strong Acidic
		4,6-5,5	Moderate Acidic
		5,6-6,5	Slightly Acidic
		6,6-7,5	Neutral
		7,5-8,5	Slightly Alkali
Soil Salinity	Electrical Conductance of saturation sludge (% Total salt)	8,5+	Strong Acidic
		0,0-0,15	Without salt
		0,15-0,35	Slightly salty
		0,35-0,65	Moderate salty
		0,65+	High salty
Organic Matter	Walkley-Black (Wet Oxidation Method) (% Organic Matter)	0-1	Very Low
		1-2	Low
		2-3	Medium
		3-4	Sufficient
		4+	High

KIND OF ANALYSIS	METHOD OF ANALYSIS	STANDARD MEASUREMENT	MEANING
Phosphorus in the Soil	Olsen Method (Phosphorus melting in Sodium bicarbonate) (P ₂ O kg/decare)	0-3	Very Low
		3-6	Low
		6-9	Medium
		9-12	Sufficient
		12+	High
Potassium in the Soil	Potassium melting in Ammonium Acetate (K ₂ O kg/decare)	0-20	Very high
		20-30	Low
		30-40	Medium
		40+	Sufficient
Lime in the soil	Scheibler Method % Lime (CaCO ₃)	0-1	High
		1-5	lime
		5-15	Moderate lime
		15-25	High lime
		25+	Very high lime

Land Assets

Agricultural land assets of Balıkesir Province is as follows as of the end of 2004:

- Total area of province: 1.452.814 ha. (14.528 km²)
- Agricultural area: 510.456 ha.
- Area convenient for irrigation: 281.439 ha.
- Ratio of agricultural area to total land: % 35,14
- Total of land out of culture: 942.358 ha.
- Ratio of land out of culture to total land: % 64,86

Land Classes

Table IV-19. Land Use Capability Classes

CLASS OF LAND	AREA (Ha)	Ratio
1. Class	46.141	3.18
2. Class	124.953	8.60
3. Class	80.953	5.55
4. Class	82.279	5.66
5. Class	672	0.04
6. Class	222.384	15.31
7. Class	865.552	59.58
8. Class	30.238	2.08
TOTAL	1.452.814	100.00

Use of Lands

Classification and distribution of the lands in Balıkesir Province are presented in Table IV-19.

Table IV-20. Classification and Distribution of Use of Lands

CULTURE LANDS USED FOR AGRICULTURE EFFECTIVELY			
Land Type	Area (ha)	% Ratio in Total Culture Lands	% Ratio in Total Lands
Field land	440.770	86.35	30.34
Oil grove land	63.002	12.34	4.34
Garden land	4.938	0.97	0.34
Vineyard land	698	0.14	0.05
Piny, Pistachio grove	1.048	0.20	0.07
Total	510.456	100.00	35.14
LANDS OUT OF CULTURE			
Land Type	Area (ha)	% Ratio in Culture Lands	% Ratio in Total Lands
Grass-Meadow land	210.020	22.29	14.45
Forest land	675.010	71.63	46.46
Land not used	38.463	4.08	2.65
Lake-pond-dam	18.865	2.00	1.30
Total	942.358	100.00	64.86

Wet farming is only made on 59.181 ha section of total 510.456 ha agricultural land. This consists of 11.59 % of agricultural lands. General distribution of land of Balıkesir Province by districts is presented in Table IV-21.

There are dominant problems related to erosion in mountainous area and hills and related to accumulations in grassy plains and valleys in Balıkesir Province. Additionally earthquakes can be included into problems related to grassy plains. Out of those problems there are a series of problems in coastal areas because of the movements in the sea. 92.4 % of the soil has problems and only 7.6 % of the soil does not any problem in Balıkesir Province.

Table IV-21. Distribution of Lands by Districts in Balıkesir Province

District	Surface Area	Agricultural area		Forest		Grassland and Pasture		Land out of Agriculture	
		Area(ha)	Ratio(%)	Area(ha)	Ratio(%)	Area(ha)	Ratio(%)	Area(ha)	Ratio(%)
Total	1,439,668	474,761	32.98	640,715	44.50	106,177	7.38	218,015	15.14
Center	144,600	52,964	36.63	36,116	24.98	2,050	1.42	53,470	36.98
Ayvalık	26,600	20,504	77.08	5,342	20.08	100	0.38	654	2.46
Balya	95,200	25,610	26.90	47,636	50.04	7,540	7.92	14,414	15.14
Bandırma	62,200	40,500	65.11	8,200	13.18	8,080	12.99	5,420	8.71
Bigadic	100,700	31,440	31.22	54,788	54.41	13,000	12.91	1,472	1.46
Burhaniye	45,263	24,108	53.26	12,549	27.72	700	1.55	7,906	17.47
Dursunbey	190,600	23,901	12.54	124,645	65.40	10,666	5.60	31,388	16.47
Edremit	70,800	23,562	33.28	40,210	56.79	4,000	5.65	3,028	4.28
Erdek	30,639	7,840	25.59	17,946	58.57	750	2.45	4,103	13.39
Gömeç	17,800	12,560	70.56	1,150	6.46	389	2.19	3,701	20.79
Gönen	115,200	43,262	37.55	48,082	41.74	18,140	15.75	5,716	4.96
Havran	55,900	13,323	23.83	20,000	35.78	1400	2.50	21,177	37.88

District	Surface Area	Agricultural area		Forest		Grassland and Pasture		Land out of Agriculture	
		Area(ha)	Ratio(%)	Area(ha)	Ratio(%)	Area(ha)	Ratio(%)	Area(ha)	Ratio(%)
İvrindi	76,280	30,290	39.71	37,628	49.33	3,303	4.33	5,059	6.63
Kepsut	89,400	19,557	21.88	44,945	50.27	15,784	17.66	9,114	10.19
Manyas	58,600	29,213	49.85	18,722	31.95	3,692	6.30	6,973	11.90
Marmara	13,986	1,854	13.26	6,775	48.44	1,313	9.39	4,044	28.91
Savastepe	42,500	13,439	31.62	18,532	43.60	4,200	9.88	6,330	14.89
Sindirgi	143,300	34,664	24.19	71,550	49.93	5,470	3.82	31,616	22.06
Susurluk	60,100	26,170	43.54	25,900	43.09	5,600	9.32	2,430	4.04

Erosion

The most important problem in mountains and hills of Balıkesir Province is erosion. Erosion, naturally, is loss of soil because the land and land cover forming naturally are soiled by human beings by processes such as burning, excess grassing, cutting forests and unaware soil process are weakened and as a result the land eroded and carried by natural forces. The heaviness of erosion shows differences with respect to precipitation, slope, structure, characteristic of flora, and human and economic activities. The most effective element in erosion is precipitation in strong rainfalls. Center of Balıkesir takes 118 mm rain a year and Bandırma takes 137.5 mm rain a year. As it is seen those are high values and sufficient that the erosion develops.

76,7 % of Balıkesir Province is covered by places whose slope is more than 13 %. When adding 16.6 % places whose slope is between 3-12 % to this amount it can be said that 93.3 % of Balıkesir Province has slope suitable to water erosion. While it is necessary that basic flora on hilly and mountainous areas be dry forest, today most important parts of those areas have been removed. For example in sections necessary to be covered by forests in Dursunbey District upper parts were plowed and chick pea and grain and other field plants have been planted here, in Bigadic and Dursunbey tobacco and other field plants, in İvrindi, Balya and Susurluk districts grains and other field plants and in the central city leguminous and grains have been produced. Those products do not cover the soil for the entire year. In addition to those negative conditions plowing of the soil vertical to izohips can accelerate erosion.

As a result of the erosion 50.5 of the soil became very shallow (0-20 cm), 33 % of the soil became shallow (20-50 cm) in Balıkesir Province. Thus 83.5 % of the soil is covered by shallow and very shallow soils.

Soil with Stones

43.97 % of the soils of Balıkesir Province experiences problem of becoming stony. Because the areas lengthening from Sindirgi, Savastepe and Dursunbey to the borders of Canakkale Province are becoming stony called *agglomerate*, with bid fractures and with

acidic character and generally hilly and mountainous. The fact that forests in those areas were destroyed and the soils started to be used for agricultural purposes accelerated the water erosion. As a result the soil becomes thinner. Although stones in those areas were collected by the farmers, the soil is plowed by tractor and as a result stones in 30 cm depth come to surface and problem of becoming stony is continuously on the agenda.

Additionally, problem of becoming stony is experienced in some part of Edremit Grassy plain. The interesting samples of the rivers coming from Kazdaglari have flood character and carrying power of water decreases when the river reach to grassy plain and leave the stones they carry and the stones accumulated in oil groves. It is observed problem of becoming stony in dead lapia areas where limestone are spread.

Flood

It can be counted that the important problems in grassy plains and valley bases in Balikesir Province are flood and marsh, water insufficiency, earthquake, and settlement problems. Generally the rivers within the borders of Balikesir Province develop in the periods when the daily rains are maximum in winter months. Excess plant destroying in hilly and mountainous areas, loosening soils in the opened fields with erosion, interrupting growing process of flora at the same period, developing evaporation at minimum level because of heat increase the amount of running water. Generally flow in rivers can develop suddenly and flood can reach to peak level in a short time. In such a cases rivers accumulate the materials carried by it on main valley bases where the speed of flow decreases and causes to form marsh areas in the places to occur ponds in a considerable short time. Particularly those floods cause large harms in residential areas and in planted areas.

Especially flood events occur in Balikesir, Sındirgi, Bigadic, Manyas and Kepsut Grassy plains and in many other grassy plains. Land problems in Balikesir Province are given in Table IV-22 according to the capability classes of the land (aridity, dampness and becoming stony etc).

Table IV-22. Erosion Areas in Balikesir Province

	Total District Area (km ²)	Area with weak erosion	Area subjected to erosion with intermediate strength	Area subjected to strong erosion	Area subjected to very strong erosion	Total Area subjected to erosion	Ratio (%)	Area without erosion
Province Total	1,452,814	143,024	166,161	981,677	131,714	1,422,576	97,92	30,238

Table IV-23. Problems with respect to Land Use Capabilities in Balıkesir Province (ha)

Capability Classes	Aridity	Dampness	Becoming stony	Water erosion	Rocky
II.III.IV	8.470	28.044	34.915	333.968	153.296
V.VI.VII.	4.866	843	82.276	1.088.608	347.251
Total	13.336	28.887	117.191	1.422.576	500.547

Land Use in the Project Site

ENERJISA has planned to establish Bandirma NGCCPP with an installed capacity of 930.75 MW in Balıkesir Province, Bandirma District Sirincavus Village, Hacılibey Location. The Power Plant will be established on an 20 ha area of a total 204 ha area. Annual total energy generation will be approximately 7,300,000,000 kWh.

The study of Environmental Master Plan with 1/100,000 scale covering the Project Site is executed by the Balıkesir Governorship (Province Special Administration) and approval process is continuing. In this context, it will be ensured the harmony between plan decisions with 1/100.000 scale not approved yet by the relevant administration and the plans to be prepared under sub-scale for the Project Site.

IV.2.5 Agricultural fields (Agricultural Development Project Area, sizes of rain-fed and dry agriculture, product patterns, their annual production amounts and productivity per unit area, pesticides used)

General Agricultural Pattern

Balıkesir Province is very rich in terms of natural flora, maquis and olive groves are wide spread in coastal zones. At inner parts on mountainous area there are oak and black pine, forests whereas there are red pines, peanut pines and spruces on higher sections of the mountains close to coast.

Manyas, Gonen, Balıkesir, Edremit, Havran, Burhaniye plains are important for agricultural production. The rate of total area of plains to the area of Balıkesir Province is 9 %. Balıkesir Province is the biggest olive producer. moreover, olive, wheat, barley, corn, sun flower, sugar beet, feeding plants, melon, water melon, citrus, vicia faba, garlic, asparagus, tomato and most of the other vegetables and fruits are grown in Balıkesir Province.

Balıkesir Province has a wide agricultural area hence it can supply agricultural products to Istanbul and other big cities close to it. olive is one of the most important agricultural product of the province. Wheat is the most important product in grain production. Sugar beet, tobacco and cotton have importance in industrial plants. Animal husbandry has important place in Balıkesir Province and small cattle and cattle

husbandry, chicken farming, fishing, beekeeping and sericulture are other primary business areas. Depending on them there are business branches such as slaughterhouses, dairies and poultry houses in order to produce and process meat, milk, milk products, and egg.

Table IV-24. Land Distribution of Balıkesir Province

Type	Area (ha)	Rate (%)
Agricultural Area	513,946	35
Grass and Meadow Area	210,014	14
Forest Area	675,010	47
Other	53,844	4
Total	1,452,814	100

Agricultural Production

Main agricultural products of Balıkesir Province are wheat, barley, sun flower, chickpea, corn, tobacco, pepper (for paste), tomato, melon, water melon, fresh bean, tritikale, alfalfa (dry plant), cockshead (dry plant) and sudan plant (green plant). Moreover, peach, almond, apple and tangerine are the fruits that is grown in Balıkesir Province.

Vegetal Production

Table IV-25. Planting Areas and Production Amounts of the Important Vegetal Products Grown in Balıkesir Province

Type	Planted Area (ha)	Production (tone)
Wheat	182,022	625,309
Barley	26,129	70,619
Sun Flower	21,010	31,296
Chickpea	13,785	17,479
Corn	10,864	461,540
Tobacco	9,285	8,834
Total	263,095	1,215,077

Field Crops

Wheat, barley and corn are the most important field crops grown in Balıkesir Province. Production amounts among the years are given in Table IV-26.

Legume Family

Table IV-26. Planting Areas and Production Amounts of Legume Family in Balıkesir Province

Kind	2003		2004	
	Planting area (ha)	Production amount (tone)	Planting area (ha)	Production amount (tone)
Wheat	179.515	560.206	182.022	625.309
Barley	26.820	68.475	26.129	70.619
Corn	8.752	458.130	10.864	461.540
Total	215.087	1.086.811	219.015	1.157.468

Leguminous seeds

Only chickpea is grown in Balıkesir Province from leguminous seeds.

Table IV-27. Planting Areas and Production Amounts of Leguminous Seeds in Balıkesir Province

Kind	2003		2004	
	Planting area (ha)	Production amount (tone)	Planting area (ha)	Production amount (tone)
Chickpea	15.450	19.324	13.785	17.479

Forage Crops

Names and production amounts of the forage crops (alfalfa, vetch, grass, cockshead etc) are in Table IV-28.

Table IV-28. Planting areas and production amounts of Forage Crops in Balıkesir Province

Name of Crop	Planting (ha)	Production (tone)
Corn	10.865	461.540
Vetch (dry plant)	8.372	35.326
Clover (dry plant)	2.943	34.240
Cockshead (dry plant)	460..	2.227
Animal beet	38	2.580
Sudan Plant (Green plant)	58.6	2.650
Triticale	1.842	6.579

Industrial Plants

Table IV-29. Planting Areas and Production Amounts of Industrial Plants Grown in Balıkesir Province

Kind	2003		2004	
	Planting area (ha)	Production amount (tone)	Planting area (ha)	Production amount (tone)
Sun Flower	23.675	36.457	21.010	31.296
Tobacco	9.295	7.586	9.285	8.834
Total	3.2970	44.043	30.295	40.130

Garden Crops

Fruit Production

Olive is the most important production is the most important production in Balıkesir Province. Olive is dense in coastal zones especially. Additionally, peach, almond, apple and tangerine are also grown.

Table IV-30. Planting Areas and Production Amounts of Important Fruits Grown In Balıkesir Province

Products	2003	2004
Olive	124.485	161.888
Peach	17.145	3.605
Apple	9.301	9.468
Tangerine	14.457	5.233
Almond	959	914
TOTAL	166.347	181.108

Vegetable Production

Pepper (for paste), tomato, water melon, melon and fresh bean) are grown in Balıkesir Province.

Table IV-31. Planting areas and production amounts of important vegetables grown in Balıkesir Province

Type	2003		2004	
	Planting area (ha)	Production amount (tone)	Planting area (ha)	Production amount (tone)
Pepper (for sauce)	2.016	48.141	1.576	34.671
Tomato	10.781	485.827	10.131	461.730
Water Melon	6.648	108.910	3.945	169.090
Melon	4.399	163.870	6.873	138.440
Green Bean	2.350	22.611	2.746	25.653
Total	26.194	829.611	1.576	34.671

Agricultural Businesses

Public Businesses

There are Susurluk Sugar Factory producing sugar by processing sugar beet from industrial plants and slaughter houses that have 1st class slaughter house license, operated by the municipalities of Balıkesir, Bigadic, Kepsut, Gobel, Pamukcu in Balıkesir Province.

Private Businesses

There are olive oil factories where olive is processed among important agricultural products together with culinary olive production facilities. Moreover, paste factories where tomato is processed and facilities where the other vegetables and fruits are processed, flavor factories where wheat is processed, feedmills where forage crops are processed, sun flower oil production facilities and sugar factory are also present in Balıkesir Province.

Animal husbandry activities such as ovine, cattle and poultry husbandries are observed in Balıkesir Province. Generally in Balıkesir Province meat produced by licensed slaughter houses is marketed both locally in the province and in other provinces. However, milk production in which milk is processed and dairy products are produced and leather facilities in which leathers of ovines are processed have a great importance in the economy of Balıkesir Province. Additionally integrated chicken slaughter houses in Bandırma City make that the poultry husbandry (broiler and chicken producing egg) widely spread.

Agricultural Characteristics of Project Site

Project Site is located on a region having brown forest soil and 6th class land use capability class with 20-30 % slope, and subjected to erosion in middle intensity. Land Existence Map that shows the Project Site is given in Annex 12. Moreover, opinion of Balıkesir Provincial Directorate of Agriculture about the development of the Project is given in Annex-26.

The related articles of Fishery Law (numbered 1380), the Law on Soil Protection and Land Use (numbered 5403) and the Olive Law (numbered 4086) will be complied will at the construction and operation stages of Bandırma NGCCPP, and the Undertaking Letter of ENERJISA related to the mentioned project is given in Annex-13.

IV.2.6 Current and planned use of surface water resources (drinking, using, irrigating, electricity generation, dam, lake, pond, product varieties and production amounts in production of aquaproducts, water transportation facilities, tourism, sports, and similar use of water and/or coast, other uses)

Rivers

Table IV-32. Rivers in Balıkesir Province

Rivers	Area
Simav Creek	900 ha.
Kocacay Creek	440 ha.
Gonen Creek	110 ha.
Marda Creek	25 ha.
Havran Creek	70 ha.
Dursunbey Creek	85 ha.
Other Creeks	40 ha.
Total River Surfaces	1670 ha.
Total surface of water	23,776 ha.

Hotaci River, located at 750 m east of the Project Site is the closest river. The mentioned river flows from north to south hence it does not have a flood risk that can affected the Project.

Moreover Sazlidere is located at 1 km away from the Project Site and Kolagil River is 2 km from it.

Lakes

Manyas Lake is one of two lakes (other is Uluabat lake) forming in the dent order located between Inegol Grassy plain and Gonen plain at the south of Marmara Sea. This lake is very well known in the world as one of the bird paradises because of bird population and ecologic values. Manyas lake is located at 15 km at the southeastern part of the Project Site as air distance.

Delta (64 ha) formed by Sigirci Creek poured into the lake and 25.000 ha area that includes the entire lake was announced as Water Birds Protection and Reproduction Area in 1977. It was included by Turkish Grand National Assembly into Ramsar Convention on 30.12.1993.

Manyas Lake whose water is fresh and that is shallow is one of the haunt places of more than 3 million birds from different species. This lake that is one of the richest lakes of our country from the point of view of bird populations is also called *Bird Lake*.

Birth lake is fed by rivers and precipitations. The creek basically feeding the lake is Kocacay entering into the lake from southern part. This creek arises from Madra Mountains at approximately 1.340 m altitude, at the beginning it is called Madra Creek and flowing from southern-northern direction combines with Yaslilar Creek arising from the skirts of Turkeli Mountain and Turkmen Hill (750 m) at Northeastern part of Ivrindi City and takes the name of Kocaavsar Creek and combining with Orhanlar Creek and Ilica Creek and pours into Manyas Lake.

Another important creek entering into Manyas Lake from the South is Muvetler Creek. This creek has a fixed base flow. But the entire water of the creek does not reach to the lake and runs to source of Karadere Regulator carrying water of Manyas Lake exit with a returning structure. Additionally the most important creek entering into the lake from the North is Sigirci creek.

Lake area of Manyas Lake changes between 157-197 km² naturally. The Lake has 5.15 m depth in maximum water level. Precipitation are of the lake is 3.182,8 km² out of lake area (average 169 km²).

Dams

There are four dams established within the borders of Balıkesir Province. Those are Caygoren, Savastepe - Saribeyler, Camkoy and Ikizcetepeler Dams respectively. Caygoren Dam is used for irrigation and preventing flood, Savastepe - Saribeyler Dam is used for irrigation, Ikizcetepeler Dams is used for irrigation, drinking and using. As to Camkoy Dam it is a waste dam.

Caygoren Dam

It was constructed over Simav River in order to irrigate 3.454 ha lands in Balıkesir-Sindirgi and Golcuk grassy plains for the purpose of irrigation and preventing flood. It is 123 kms away from south of the project area as air distance.

Savastepe-Saribeyler Dam

It was constructed over Saribeyler Creek in order to irrigate 1.750 ha area in Balıkesir-Savastepe and Saribeyler grassy plains. Savastepe-Saribeyler Barajı is 115 kms away from southwest of the project area as air distance.

Ikizcetepeler Dam

It was constructed over Kille Creek in order to provide drinking, using and industrial water until 2020. This dam whose constructions started in 1986 was completed in 1991. It is approximately 93 kms away from south of the project area as air distance.

Camkoy Dam

Camkoy Dam is over side creek of Ayitlidere descending from Camkoy mixing Simav River at 10 kms north of Bigadic between Kacakir and Dedekiran. Camkoy Dam is approximately 99 kms away from south of the project area as air distance.

The purpose of Camkoy Dam is to prevent polluting resulted from boron facilities in the vicinity of Bigadic, Simav River and Balikesir, Kepsut, Susurluk- Karacabey Grassy plains.

Water with boron coming from Boron facilities is accumulated in reservoir of Camkoy Dam for 11 month and is run to Simav River for 1 month. Thus it is provided that Simav River is clean for 11 months and Balikesir and Kepsut Grassy plains can be irrigated healthily during 11 month.

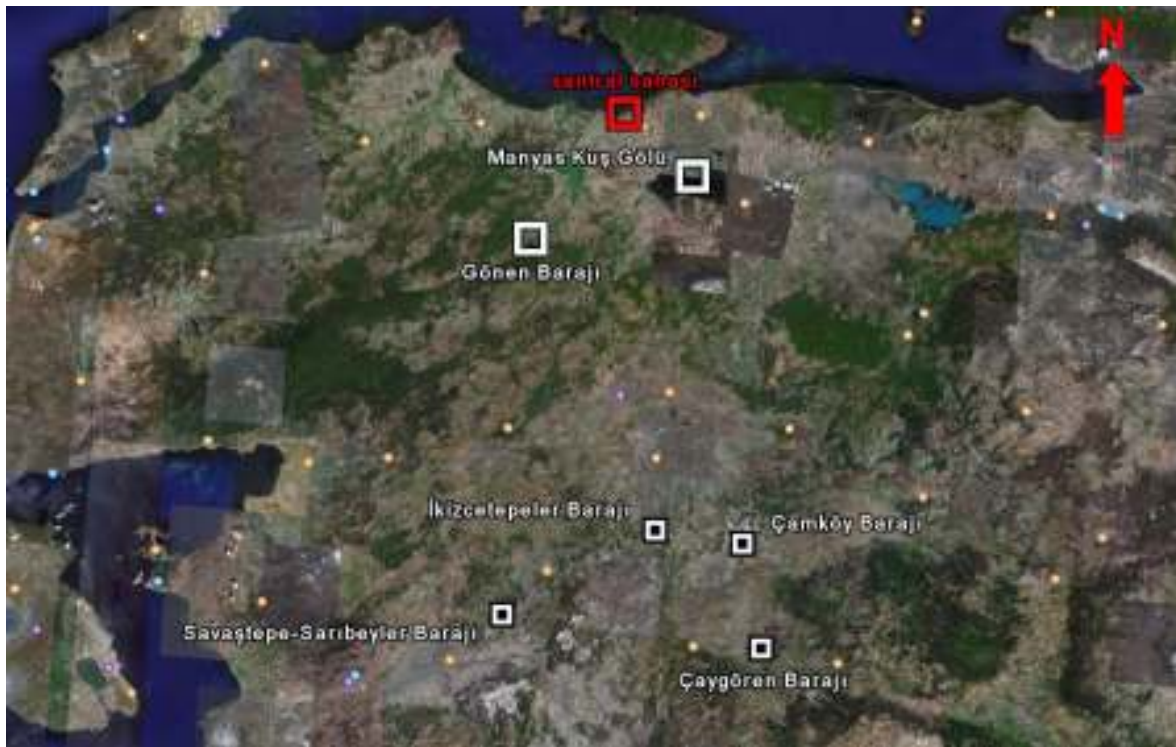


Figure IV-16. Lakes and Dams in the Project Area and Vicinity

Ponds

Ponds completed by SHW, ponds whose constructing activities have been continued by SHW and ponds constructed by the General Directorate of Rural Affairs are on Table IV-33.

Table IV-33. Ponds in Balikesir Province (SHW)

Natural lake surfaces	17.425 ha
Manyas Lake (18.00 altitude)	17.425 ha
Pond Reservoir Surfaces	652 ha
Antimon Pond	12 ha
Hacihuseyin Pond	28 ha
Merinos Ponds	21 ha
Halkapinar Pond	18 ha
Karakol Pond	17 ha
Ibirlar Pond	25 ha
Karacaoren Pond	8 ha
Alidemirci Pond	31 ha
Degirmenli	12 ha
Sove	12 ha
Soguksu	10 ha
Ovacik	16 ha
Sahinburgaz	10 ha
Kocaavsar	15 ha
Samli	40 ha
Natural lake surfaces	69 ha
Kavakli	17.425 ha
Korucu	17 ha
Ponds constructed by the General Directorate of Rural Affairs	14 ha
TOTAL	277 ha

Seas

Balikesir Province has long coast to Marmara and Aegean Seas and high tourism potential. Coastal length in Marmara Sea is 102.75 km and coastal length in Aegean Sea is 115,5 km. Additionally Marmara City (Marmara Island) that is within the borders of Province has 72.5 km coast.

Table IV-34. Cities that Have Coast to the Sea of Balikesir Province and Their Lengths

NAME OF CITY	COASTAL LENGTH	NAME OF SEA	RATE TO PROVINCIAL COAST %	LENGTH OF BEACH (km)
Ayvalik	54	Aegean Sea	14.35	15
Bandirma	60	Marmara Sea	15.95	-
Burhaniye	12	Aegean Sea	3.19	6
Edremit	32	Aegean Sea	8.5	31
Erdek	34.75	Marmara Sea	9.24	0.455
Gomec	17.5	Aegean Sea	4.65	2.5
Gonen	8	Marmara Sea	2.12	6
Marmara	72.5	Marmara Sea	29.25	23.8

(NOTE: Coasts of Islands (except Marmara Island) are not included into coastal lengths.

IV.2.7 Hydrologic Characteristics (Physical, Chemical, Bacteriological and Ecological characteristics of rivers, lakes and other wetlands from surface water sources, seasonal changes in this scope and coast ecosystems)

Table IV-35. Rivers Rising in Balıkesir Province and Crossing Through Balıkesir Province

Name of creek	Place where it arises	Place where it crosses	Place where it pours	Length (km)
Simav Creek	Kutahya	Sindirgi	Marmara Sea	175
Dursunbey Creek	Alacam Mountain	Joins with Simav Creek	Marmara Sea	65
Kille Creek	Dursunbey	Joins with Simav Creek	Marmara Sea	97
Yagcilar Creek	Bigadic	In Kepsut (Simav)	Marmara Sea	30
Madra Creek	Ivrindi	Ayvalik,Altinova	Aegean Sea	48.5
Atnos Creek	Kutahya	Sindirgi (Simav)	Marmara Sea	0
Uzumcu Creek	Ivrindi	Balıkesir (Simav)	Marmara Sea	56
Kizikli Creek	Havran	Burhaniye	Aegean Sea	30
Karadere	Madra Mountain	Burhaniye Creek	Aegean Sea	19
Karica Creek	Madra Mountain	Burhaniye Creek	Aegean Sea	19
Edremit Creek	Kaz Mountain	Edremit	Aegean Sea	28
Biller Creek	Kaz Mountain	Edremit	Aegean Sea	55
Havran Creek	Kaz Mountain	Havran, Edremit	Aegean Sea	46
Gonen Creek	Kaz Mountain	Gonen	Marmara Sea	60
Murvetler Creek	Samli County			
Bombay Creek	Bigadic	Joins with Simav	Marmara Sea	
Degirmenlik Creek	Dursunbey	Joins with Bombay	Marmara Sea	51
Kocacay	Madra Mountain		Manyas Lake	140

IV.2.8 Species and other characteristics of the waters where cooling water will be procured (Natural characters of those species, species protected by national and international Regulations, reproducing, food, sheltering and living environments of those species, protection decisions specified for those environments, weaving movements, temperature, depth, salinity etc.)

Water to be used for the purpose of cooling will be taken from depth place known as poor zones of sea in view of species varieties. This zone is defined as afotic zone in zonation classification in vertical direction in accordance with light. Afotic zone is also known as dark zone. While the temperature is decreasing viscosity increase in parallel with increasing the pressure. Water is calm in this zone and flows are a little. Because there is no light in this zone it is impossible to mention primary productivity known as food amount produced by photosynthetic (food produced as a result of photosynthesis) in unit time. This zone is very poor in view of oxygen and is very rich in bacterial activities.

But, it was studied water samples taken from the zone from the point of view of planktonic organism in order to inform about current ecologic state generally (see Annex 19, plankton analysis) and they are counted. A list of current species of vertebrate was prepared with either visiting the fishermen and literature studies out of those studies.

Species of vertebrate

Sea vertebrate is important because of the view of sea ecosystems that they are main consumers of primary productivity in the sea and because they are important local and national income sources such as fishing. For that reason it is possible to display ecologic characteristics of pelagic zone and to give data related to current vertebrate groups together with planktonic organisms. It will be provided not to harm fish and basic groups of food resources of fish by realizing an effective drain processing by means of mentioned activity.

Table IV-36. Species of Sponge, Molluscs, Knids, and Other Species in the Project Site

TAKSONS IN LATIN		COMMON NAMES
PHYLUM	PORIFERA	SPONGES
	MYXILLIDAE	
	Crambe crambe	
	Euspongia officinalis	Bath Sponge
PHYLUM	CNIDARIA	KNİDS
	PELAGIIDAE	
	Pelagia noctiluca	
	ULMARIDAE	
	Aurelia aurita	Jelly Fish
	RHIZOSTOMATIDAE	
	Rhizostoma pulmo	
	CERIANTHIDAE	
	Cerianthus membranaceus	
	ACTINIDAE	
	Anemonia sulcata	Anemon
	DENDROPHYLLIDAE	
	Leptosammia pruvoti	
PHYLUM	MOLLUSCA	MOLLUSCS
CLASSIS	BIVALVIA	
	PINNIDAE	
	Pinna nobilis	
	PECTINIDAE	
	Pecten jacobaeus	
	Clamys varia	
	LIMIDAE	
	Lima inflata	
	VENERIDAE	

	Tapes decussatus	Sand mussel
	Tapes aureus	Sand mussel
	Venus gallina	White Sand mussel
	Venus verrucosa	Sand mussel
	MYTILIDAE	
	Mytilus galloprovincialis	Mussel
CLASSIS	GASTROPODA	
	STROMBIDAE	
	Strombus decorus	
	MURICIDAE	
	Trunculariopsis sp	Snail with prick
	Murex brandaris	Snail with prick
	BUCCINIDAE	
	Buccinum sp	
CLASSIS	CEPHALOPODA	
	OCTOPODIDAE	
	Octopus vulgaris	
	SEPIDAE	
	Sepia officinalis	
PHYLUM	ARTHROPODA	JOINT LEGGED
SUBPHYLUM	CRUSTACEA	
ORDO	DECAPODA	
	LEPADIDAE	
	Lepas ansifera	
	PENAEIDAE	
	Sicyonia carinata	
	HIPPOLYTIDAE	
	Lysmata seticaudata	
	STENOPODIDAE	
	Stenopus spinosus	
	PALEOMODIDAE	
	Paleomon elegans	
	Paleomon serratus	
	PANDALIDAE	
	Pleisionika narval	
	SCYLLARIDAE	
	Scyllarides latus	Cray Fish
	PALINURIDA	
	Palinurus elephas	
	NEPHROPIDAE	
	Palinurus sp	
	DIOGENIDAE	
	Dardanus calidus	
	Diogenes pugilator	
	Clibanarius erythropus	
	Calcinus tubularis	

	PAGURIDAE	
	Pagurus anachoretus	
	Pagurus prideaux	
	GALATHEIDAE	
	Galathea squamifera	
	Galathea strigosa	
	Munida rugosa	
	LEUCOSIIDAE	
	Ilia nucleus	
	MAJIDAE	
	Macropodia sp	
	Inachus phalangium	
	Inachus thoracicus	
	Herbstia condyliata	
	Maja crispata	
	XANTHIDAE	
	Pilumnus sp	
PHYLUM	ECHINODERMATA	SKIN WITH PRICK
	ANTEDONIDAE	
	Antedon mediterranea	Star with eaves
	OPHIOTHRICIDAE	
	Ophiotrix sp	Snake star
	ASTERIDAE	
	Marthasterias glacialis	Sea Star
	Coscinasterias tenuispina	
	ASTROPECTENIDAE	
	Astropecten aranciaus	
	Astropecten spinulosus	
	ECHINASTERIDAE	
	Echinaster sepositus	
	OPHIDIASTERIDAE	
	Ophidiaster ophidianus	
	DIADEMATIDAE	
	Centrostephanus longispinus	
	ARBACIIDAE	
	Arbacia lixula	
	ECHINIDAE	
	Paracentrotus lividus	
	TOXOPNEUSTIDAE	
	Sphaerechinus granularis	
	SPATANGIDAE	
	Spatangus purpureus	
	HOLOTHRUDAE	
	Holothuria forskali	
	Holothuria polii	
	Holothuria tubulosa	

	STICHOPODIDAE	
	Stichopus regalis	
PHYLUM	TUNICATA	OVERALLS
CLASSIS	ASCIDIA	
	POLYCITORIDAE	
	Clavelina nana	
	Clevalina lepadiformis	
	CIONIDAE	
	Diazona violacea	
	Ciona intestinalis	
	ASCIDIIDAE	
	Phallusia mammilata	
	Phallusia fumigata	
	PYURIDAE	
	Halocynthia papillosa	
	Microcosmus sp	
PHYLUM	VERTEBRATA	VERTEBRATES
SUBPHYLUM	PISCES	
	TORPEDINIDAE	
	Torpedo marmota	Electricity Fish
	RAJIDAE	
	Raja clavata	Dasyatis Centroura
	DASYATIDAE	
	Dasyatis pastinaca	vatoz with prick
	CLUPEIDAE	
	Alosa caspia	Tirsi
	Sardina pilchardus	Sardine
	Sardinella aurita	Big sardine
	CONGRIDAE	
	Conger conger	Migri
	BELONIDAE	
	Belone belone	Zargana
	MERLUCCIIDAE	
	Merluccius merluccius	Bakalyaro, Berlam
	GADIDAE	
	Merlangius merlangius	Mezgit
	Antonogadus megalokynodon	Poppy
	SERRANIDAE	
	Epinephelus sp	Orfoz
	Serranus cabrilla	Asil Hani
	Serranus hepatus	Hani with points
	Serranus scriba	Yazili hani
	MORONIDAE	
	Dicentrarchus labrax	Sea bass
	CEPOLIDAE	
	Cepola rubescens	Kurdela Fish

	POMATOMIDAE	
	Pomatomus saltator	Blue fish
	CARANGIDAE	
	Lichia amia	Akya
	Trachurus trachurus	Horse Mackerel
	MULLIDAE	
	Mullus surmuletus	Striper red mullet
	Mullus barbatus	Red Mullet
	CENTRACANTHIDAE	
	Spicara smaris	İzmarit
	SPARIDAE	
	Boops boops	Kupes
	Dentex dentex	Sinagrit
	Diplodus annularis	İsparoz
	Diplodussargus	Sargoz
	Diplodus vulgaris	Karagoz
	Lithognathus mormyrus	Mirmir
	Pagrus pagrus	Fangri
	POMACENTRIDAE	
	Chromis chromis	Papaz
	LABRIDAE	
	Labrus viridis	Lapın , plant fish
	Coris julis	Sun fish
	Thalassoma pavo	Day Fish
	Symphodus ocellatus	Plant fish
	Symphodus rostratus	Plant fish
	Symphodus cinereus	Plant fish
	URANOSCOPIDAE	
	Uranoscopus scaber	Tiryaki
	TARACHINIDAE	
	Trachinus arenaus	Trakonya
	SCOMBRIDAE	
	Sadira sarda	Palamut
	Scomber japonicus	Kolyoz
	Scomber scomber	Uskumru
	BLENNIIDAE	
	Parablennius gattorugine	Horozbina
	Parablennius tentacularis	Horozbina
	GOBIIDAE	
	Gobius cobitis	Rock fish
	Gobius bucchichi	Rock fish
	MUGILIDAE	
	Mugil cephalus	Grey mullet
	Liza aurata	Grey mullet
	Chelon labrosus	Mavraki, Grey mullet
	ATHERINIDAE	

	Atherinidae sp	Silver fish
	SCORPAENIDAE	
	Scorpaena porcus	İskorpit
	Scorpaena scrofa	İskorpit
	BOTHIDAE	
	Arnoglossus kessleri	Small plaice
	SCOPHTHALMIDAE	
	Psetta maxima maeotica	Turbot
	SOLEIDAE	
	Solea solea	Sole
	Solea kleinii	Sole

It was not encountered any endemic species at the Project Site that are unique, endangered and needs to be protected.

There is no hunting area determined by EU within the impact area of the project.

Cooling water requirement will be met by the water to be taken from the sea and it is planned that Boiler Feed Water necessary for the facility less than cooling water will be met with desalination of sea water or from the resources of the region. Oceanographic and Geologic-Geophysics Study Report prepared by MCH Sea Researches Ltd. Sti. for the mentioned Project Site is given in the Annex 14.

Assessment of CTD Data

As a result of commenting on physical oceanographic parameters given in Oceanographic and Geologic-Geophysics Study Report, some graphics are obtained. (see from Figure IV-17 to 21). By the evaluation those graphics and numeric results the following physical oceanographic characteristics of the project area were made:

Temperature profiles of sea water have appearance of typical Fall profile and it is seen that sea water temperature forms a surface water layer with fixed gradient until approximately 17 m depth and then as of this depth it forms a secondary water layer with negative gradient until the measurement depth with the effect of Mediterranean sea water from the measurement results and obtained graphics. It was determined that temperature change was between 19.05°C and 19.53°C at the surface level and 16.79°C at the base of the sea.

As to salinity change of sea water, effect of Mediterranean sea water is seen clearly. Salinity values change between 25.44 % and 25.55 % at the surface of sea and it is seen that salinity values increase a little until 16 m depth from surface of sea and as of this depth it is seen effect of Mediterranean Sea, that is, salinity values increased more and reached 38.18 % in CTD Station number 5 (in 34 m depth).

Sea water density parameters are similar to conductivity and salinity profiles toward measurement depth. Two different layers clearly are detected clearly.

Current Measurements

In order to define current system of the impact area, current measurements are carried on with DCS 3900 Doppler Current meter of Aanderaa Firm in 1 current point on 18 October 2007 for 12 hours.

Water depth is 20 m in measurement point. Current meter was fixed 15 m up from the base of sea. In the measurements of current data collecting and sampling range was selected as 10 minutes and the values read on 3315 display unit were recorded with real time.

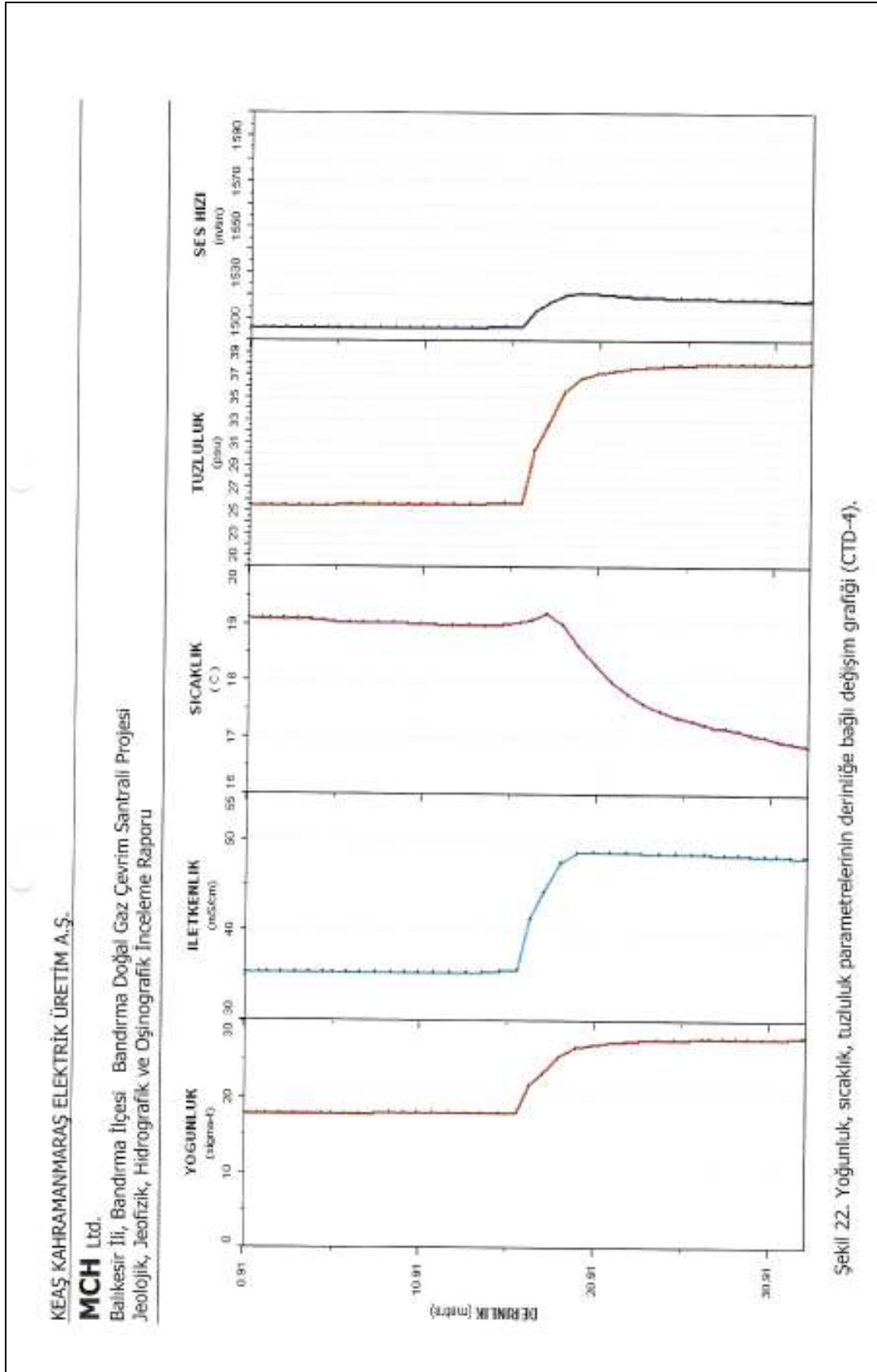


Figure IV-17. Change of density, heat, and salinity parameters depending on the depth (CTD-4)

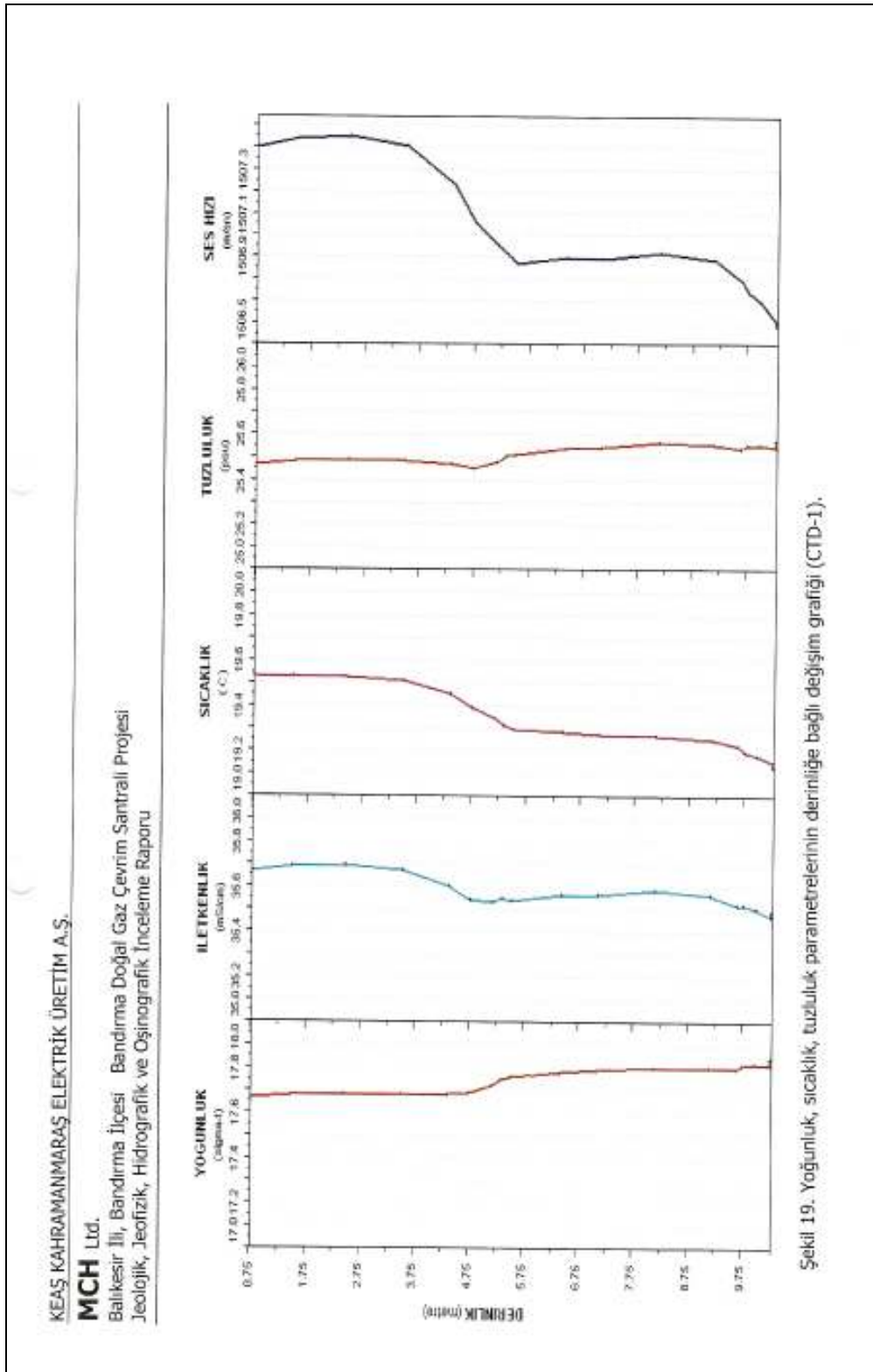


Figure IV-18. Change of density, heat, and salinity parameters depending on the depth (CTD-1)

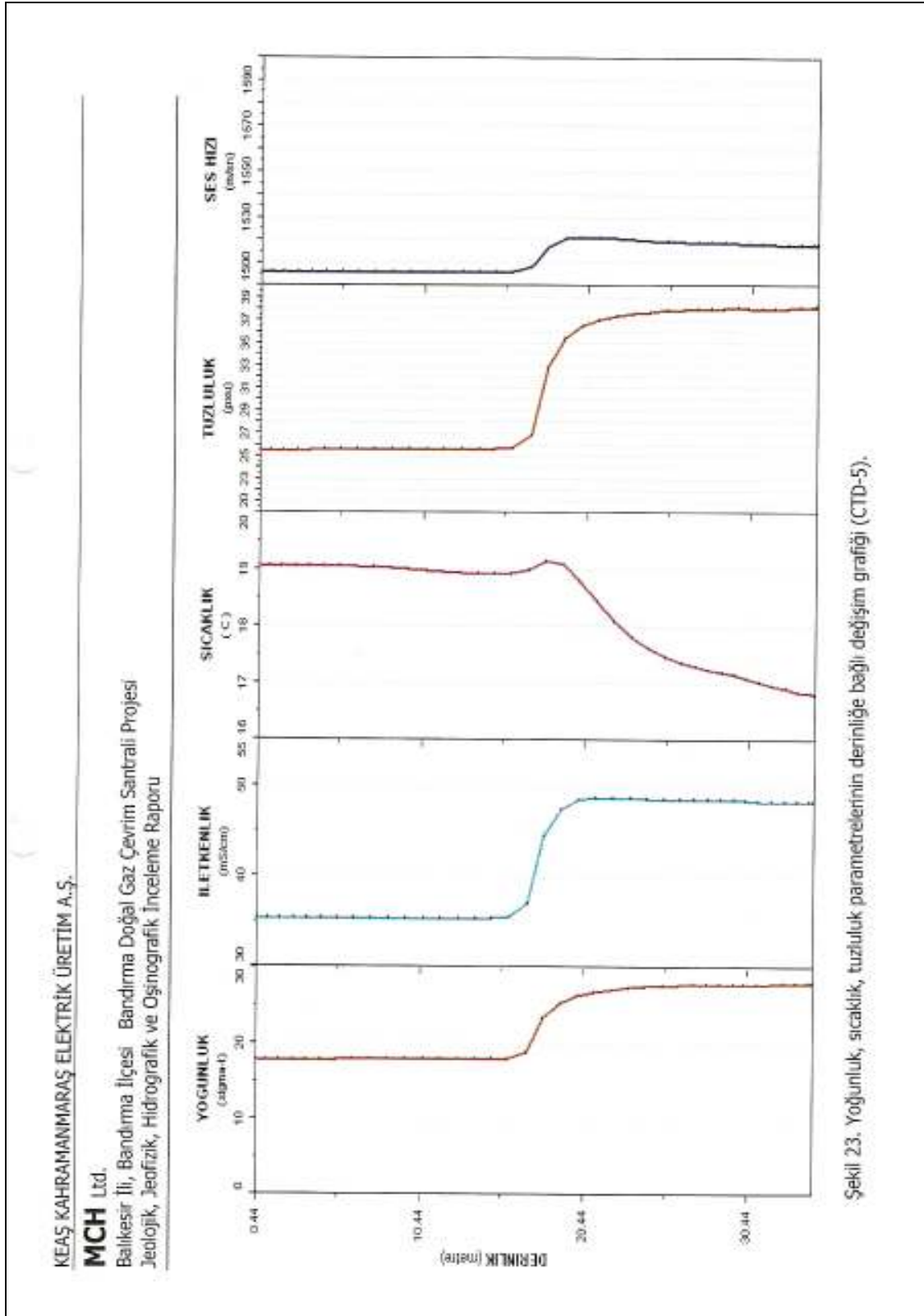


Figure IV-19. Change of density, heat, and salinity parameters depending on the depth (CTD-5)

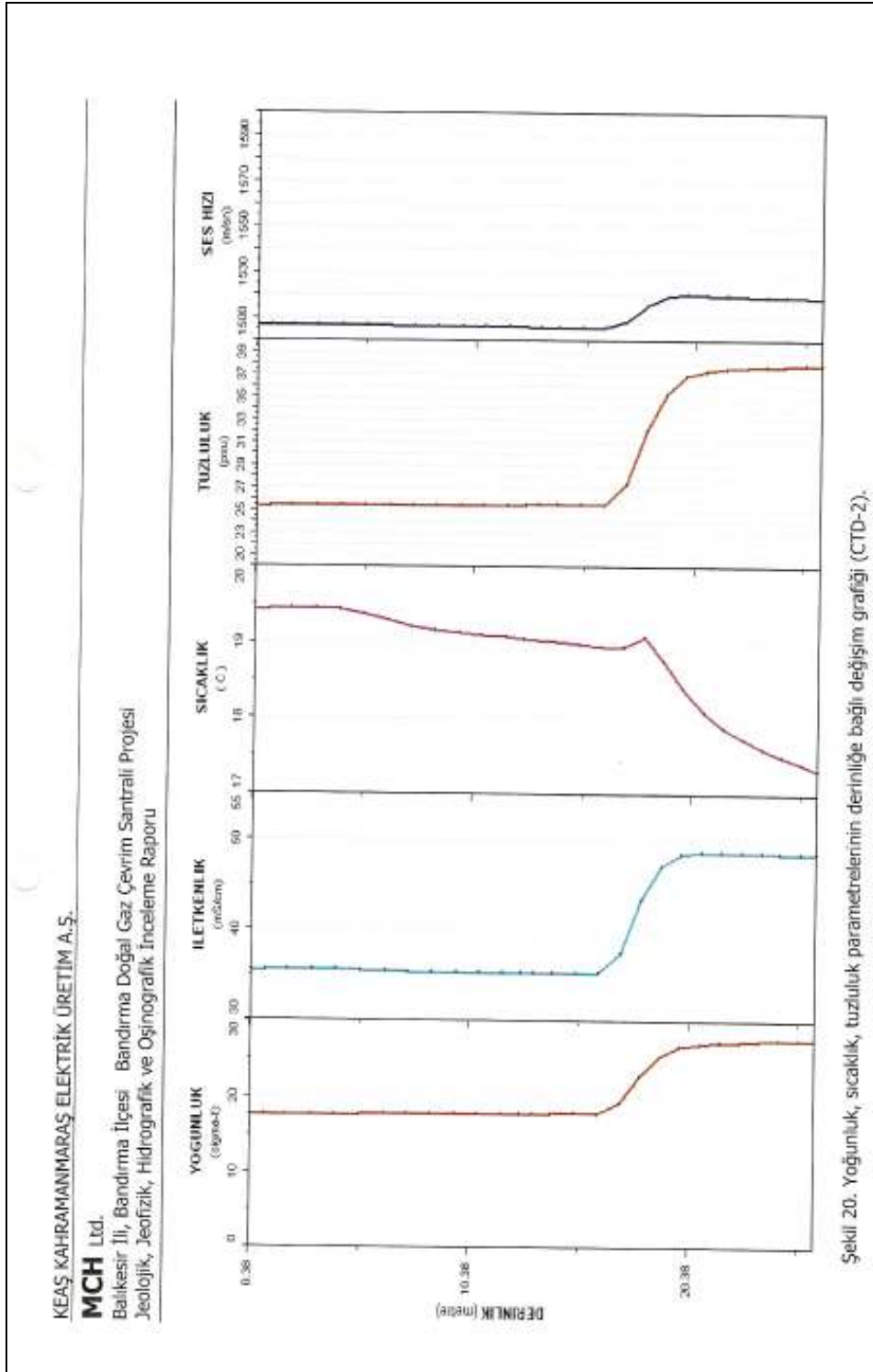


Figure IV-20. Change of density, heat, and salinity parameters depending on the depth (CTD-2)

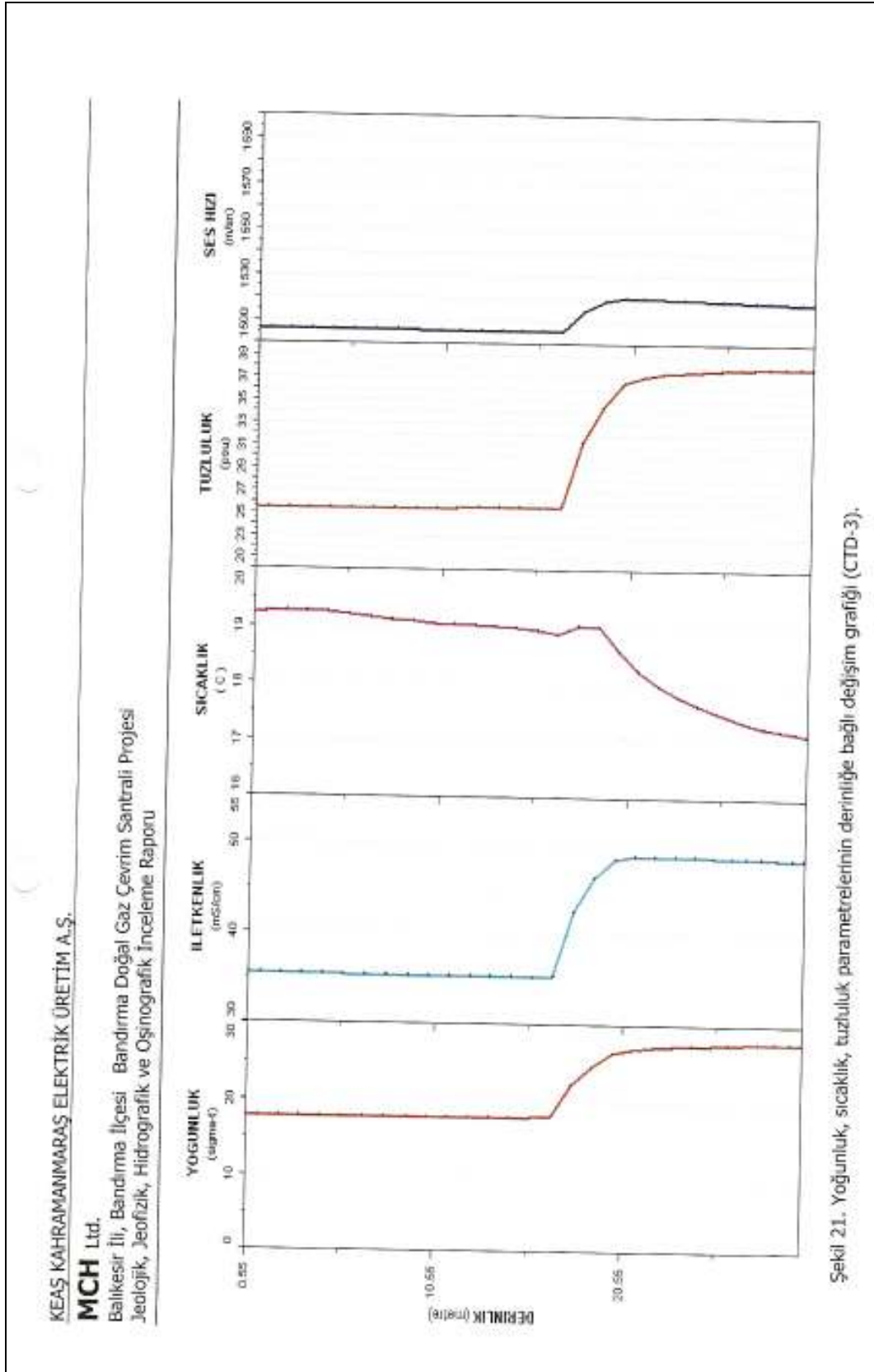


Figure IV-21. Change of density, heat, and salinity parameters depending on the depth (CTD-3)

Measured current values are the values in the time of measurement and show the state of the current in the sea and weather conditions at the time of measurement.

Sea state in the time of measurement: 0 (zero), wind: blows 1-2 kts from 0⁰-45⁰ range and height of wave is 5-10 cm.

Commenting Current Measurement Results

Current data set of measurement point is given in Table IV-37, current direction-time, current speed-time graphics and current direction-speed opening diagrams of are given in Figure IV-22 and 23.

In current direction-time, current speed-time graphics, measurement values and change of direction and speed of the current and basic profile of current in direction-speed opening are shown. As a result of commenting those graphics when current direction is studied it was determined that the effective direction of the current was average 322.8° in current point and current speed was average of 2,67 cm/s.

At the end of processing and commenting the data obtained from batimetric, geologic, geophysics and oceanographic researches made in the scope of the project the following general results were reached:

When engineering seismic studies made in the Project Site was studied from the point of view of ground definition it was determined that two sismo-litologic units exist in the ground. It is seen Unit (A) with low reflecting character forming updated sediments saturated by the water in the upper part and Unit (B) that is permanent in cross sections under the Unit (A). We can accept that this unit is the unit forming acoustic base in the Project Site.

It was determined that rising in sea base close to the coast was caused by sediments loaded by gas in A unit.

As a result of commenting records of sonar it was seen that sea base was generally plain and any unnatural formations are not encountered.

It was determined that temperature change was between 19.05°C and 19.53°C at the surface level and 16.79°C at the base of the sea. The effect of Mediterranean sea on the salinity change of sea water is clearly observed.

Salinity values change between 25.44 % and 25.55 % at the surface of sea and it is seen that salinity values increase a little until 16 m depth from surface of sea and as of this depth it is seen effect of Mediterranean Sea, that is, salinity values increased more and reached 38.18 % in CTD Station number 5 (in 34 m depth).

The highest density value at point 5 is 28.06 % on the base of sea. When studying direction of current, it was determined that the dominant direction of the current was average 322.8° in current point and current speed was average of 2,67 cm/s.

Table IV-37. Measurement Data of Flow

KEAŞ KAHRAMANMARAŞ ELEKTRİK ÜRETİM A.Ş.

MCH Ltd.Balıkesir İli, Bandırma İlçesi Bandırma Doğal Gaz Çevrim Santrali Projesi
Jeolojik, Jeofizik, Hidrografik ve Oşinografik İnceleme Raporu

Tablo 6. Akıntı veri setleri

AKINTI ÖLÇÜM VERİLERİ

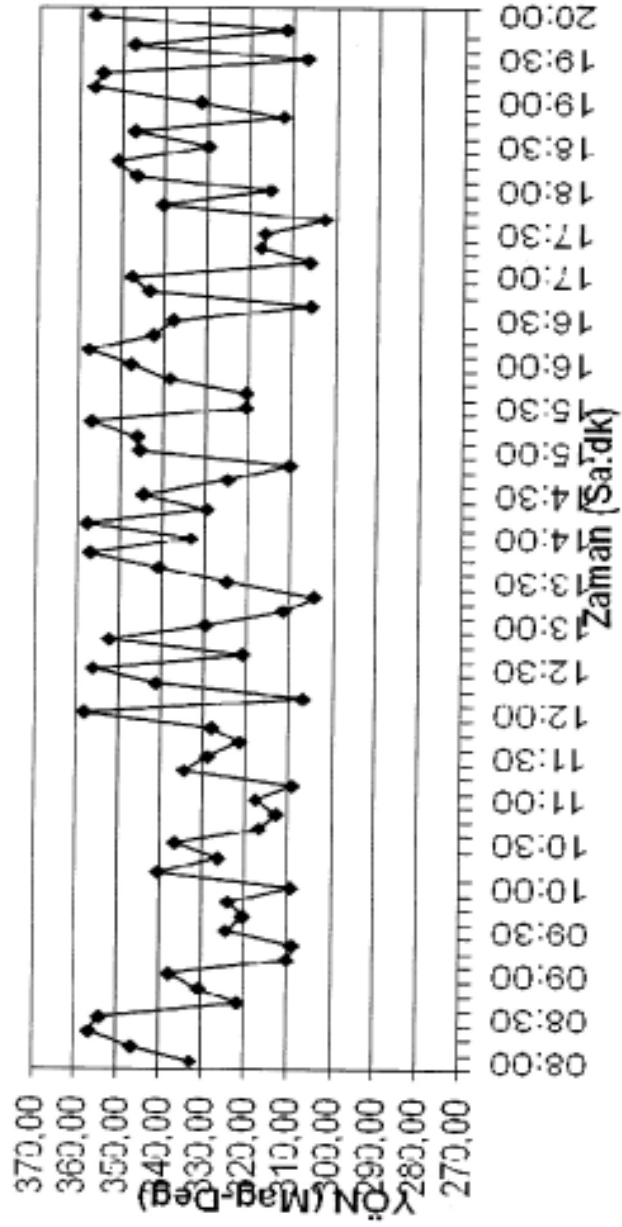
ZAMAN	HIZ	YON	ZAMAN	HIZ	YON
sa:dk	cm/sn	deg,	sa:dk	cm/sn	deg,
08:00	2,55	332,93	14:30	3,56	345,03
08:10	3,16	346,80	14:40	1,29	325,15
08:20	2,58	357,07	14:50	3,05	310,52
08:30	2,45	354,67	15:00	3,75	345,97
08:40	3,15	321,99	15:10	2,50	346,54
08:50	2,10	330,92	15:20	1,20	357,49
09:00	2,90	338,19	15:30	3,77	321,11
09:10	3,86	310,25	15:40	2,78	321,02
09:20	2,23	309,02	15:50	3,32	339,03
09:30	1,18	324,72	16:00	3,88	348,14
09:40	2,62	320,86	16:10	1,63	358,20
09:50	2,72	324,28	16:20	2,86	342,96
10:00	3,12	309,47	16:30	3,63	338,35
10:10	3,45	340,87	16:40	2,72	305,81
10:20	2,42	326,71	16:50	2,75	343,97
10:30	1,43	337,01	17:00	1,41	348,00
10:40	3,81	317,05	17:10	3,39	306,18
10:50	1,26	312,86	17:20	2,05	317,76
11:00	1,49	317,93	17:30	2,28	316,74
11:10	3,13	309,23	17:40	2,97	302,82
11:20	3,12	334,95	17:50	2,80	340,86
11:30	3,05	329,21	18:00	1,66	315,37
11:40	1,83	321,85	18:10	1,83	347,00
11:50	1,36	328,37	18:20	3,27	351,60
12:00	3,58	358,63	18:30	3,45	330,16
12:10	3,55	306,96	18:40	3,43	347,53
12:20	3,84	341,76	18:50	3,82	312,42
12:30	2,36	356,67	19:00	2,24	331,87
12:40	1,90	321,41	19:10	1,57	357,24
12:50	3,06	353,02	19:20	2,40	355,37
13:00	1,24	330,05	19:30	3,75	307,05
13:10	2,03	311,68	19:40	2,52	347,74
13:20	3,88	304,57	19:50	2,83	311,83
13:30	1,98	325,14	20:00	2,99	357,20
13:40	3,35	341,28			
13:50	2,70	357,51			
14:00	2,02	333,70			
14:10	3,65	358,28			
14:20	1,41	329,91			

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Jeolojik, Jeofizik, Hidrografik ve Oşinografik İnceleme Raporu

AKINTI YÖN-ZAMAN GRAFİĞİ



Şekil 25. Akıntı Yön-zaman grafiği

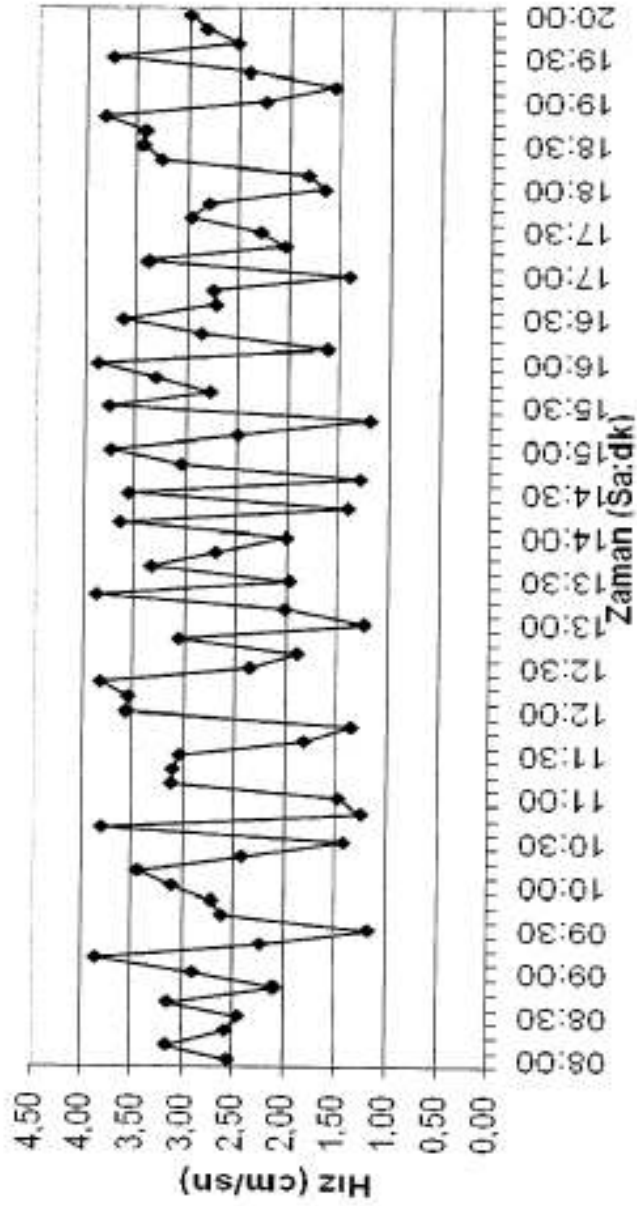
Figure IV-22. Flow direction time graphic

KEAŞ KAHRAMANMARAŞ ELEKTRİK ÜRETİM A.Ş.

MCH Ltd.

Balıkesir İli, Bandırma İlçesi Bandırma Doğal Gaz Çevrim Santrali Projesi
Jeolojik, Jeofizik, Hidrografik ve Oşinografik İnceleme Raporu

AKINTI HIZ-ZAMAN GRAFİĞİ



Şekil 26. Akıntı hız-zaman grafiği

Figure IV-23. Flow Speed-Time graphic

IV.2.9 Thermal and Geothermal Water Resources (Their physical and chemical characteristics, flow rates, current and planned uses)

Geothermal Resources

Turkey is in the first position in Europe and in the 7th position in the world from the point of view of geothermal potential. Particularly geothermal resources are concentrated in Western Anatolia. Balıkesir Province that is in this region has important potential from the point of view of geothermal water resource. Today, geothermal resources are used not only as thermal spring but also for heating the cities and greenhouses. Geothermal areas in Balıkesir Province are given in Table IV-38.

The first geothermal heating application in our country was realized in 1964 by heating a tourism facility (hotel). The first city heating in the country with geothermal resources was applied in Gonen in 1987 and 3400 houses were heated.

Table IV-38. Identified Geothermal Energy Resources of Balıkesir Province

Name of geothermal area	Average Temperature (°C)	Total Flow (l/s)
Balıkesir-Pamukcu	61	88
Balıkesir-Bigadic-Hisarkoy	97,8	120
Balıkesir-Sindirgi-Hisaralan	72	100
Balıkesir-Edremit-Gure	50	25
Balıkesir-Edremit-Derman	55	99
Balıkesir-Balya-Ilica	65	30
Balıkesir-Gonen	77	63
Balıkesir-Manyas-Ilicabogazi-	60	3
Balıkesir-Manyas-Kizik	50	7
Balıkesir-Susurluk-Omerkoy	30	2
Balıkesir-Susurluk-Yildiz	56	18

IV.2.10 Protection Areas (National Parks, Nature Parks, wetlands, Nature Monuments, Nature Protection Areas, Biogenetic Rezerve areas, Natural Protected areas and Monuments, Archeological, historical and Cultural Protected Areas, Private Environmental Protection Areas, Private Protection Areas, Tourism Areas)

There is not any protection area within the impact area of Bandırma Natural Gas Combined Cycle Power Plant. The protection areas of Balıkesir Province are as follows:

“Bird Paradise National Parks”, “National Parks”, “Nature parks”, “Nature Monuments” and “Protected Areas” defined in the 2nd Article of the Code about National Parks numbered 873 and specified in accordance with the article 3 of this Law

Bird Lake is within the borders of Bandırma and Manyas Districts of Balıkesir Province. Bird Lake is located at south of Marmara Sea in a dent lengthening between Uludağ and Biga peninsula. The base of this dent consists of Bird and Uluabat (Apolyont)

Lakes and wide grassy plains around this dent and High Mountain and hills encircle those lakes. Length of the lake lengthening east-west direction is 20 kms and its width is 14 km.

Bird Lake includes abundant food (that is it is eutropic) from the point of view of ecologic side and is a wetland area that is argilotrophic (clayed) from the point of view of limnologic side. Because it includes colloidal clay its water is continuously muddy. The deepest place of this lake whose water is fresh is 4 m and average depth is 1-2 m. There are a lot of planktons in the lake. The place where the cover of plant is the most abundant is birth paradise.

Europe Council awarded Birth Paradise National Park with "A" class diploma given to well protected and directed area in 1976. Diploma was renewed four time in five year periods in 1981, 1986, 1991 and 1996.

In 1994, Turkey accepted Ramsar Convention (Especially Protecting the Areas that Have International Importance as Living Area of the Water Birds) and became a party of this convention. Hence, 10.200 ha section at the east of the lake was included into Ramsar List by issuing in the Official Gazette numbered 21337 and dated 15.04.1994, and the entire lake was included into this list by issuing in the Official Gazette numbered 23314 and dated 15.04.1998 with the *Wet Areas Communiqué* Number: III. Hunting-Wild Life General Directorate of the Ministry of Environment and Forestry (MoEF) is responsible for managing the national park. 16.400 ha area that was the entire lake was announced as National Park in 2005.

Using Purposes of the Area

Manyas (Bird) Lake has played important roles in economic, cultural and social life of the people living vicinity throughout the history. The societies living in the coasts of the lake benefited from the opportunities of the lake for meeting their requirements and for commerce in the past like today. Nowadays, Bird Paradise National Park is used for resting, tourism and training purposes.

Kazdagi National Park

Kazdagi National Park was located at the side of Kazdagi looking at Edremit Bay on 21.300 ha area in 1993. The lowest place of the area is Aegean Sea 1 km away from the entrance of Avcilar Village. The highest place is Karatas Hill with 1.774 m altitude. It is very rich in terms of flora and fauna species. Some species are found only in Kazdagi and they are endemic. And for that reason they are under protection. There is also Sutuven waterfall in Kazdagi National Park.

Ayvalik Adalar Nature Park

There is Ayvalik-Adalar Nature Park connected to Nature protection and National Park Branchy Directorate of Environment and Forest Directorate of Balikesir Province.

Kazdagi Goknar- Protection Area

The area where Abies Equitruyani is the is widely spread cover two sections and 240 ha area and this area was specified as Nature Protection Area. Goknar tree of Kazdagi is not mixed with the other trees.

Dursunbey Wild Life Developing Area that is “Wild Life-Protection Areas and Wild Life Settlement Area” specified by Ministry of Environment and Forestry pursuant to the Land Hunting Law

It has been thought that the red deer in Dursunbey–Yayla Deer Reproducing Station established in 1970s are gained to the nature and after reaching optimum population in the nature it will be given permission for hunting them within a definite plan. Consequently target specie is red deer and it is also aimed at reproducing other species (wolf, bear, wild pig, rabbit and fox etc) and reaching to optimum population.

PROMENADE PLACES

Areas allocated for the use of people for recreasyonel usee without destroying the natural structure in compliance with the Forest Law numbered 6831.

Degirmenbogazi Promenade Place

It is in province center of Balikesir-Bursa Highway. It is 10 kms awayfrom Balikesir.

Necati Sezgin Promenade Place

It is in 40th km in Balikesir –Edremit Highway.

Edremit Talimalani Promenade Place

It is in 40th km in 20th km of Edremit–Kaklim Road.

Pasalimani Promenade Place

It is a peninsula on Ayvalik–Kucukkoy (Sarimsakli) road and is covered by red pine forest.

Geothermal Sources in Balikesir**Kepekler Thermal Bath**

It is on Susurluk – Bandirma Highway, 10 kms away from Susurluk in Kepekler Village. Its heat is 45 °C and it smells a little sulfur

It includes ash, Sodium (Na), Calcium (Ca), magnesium (Mn), sulfate (SO₄), chloride (Cl) and bicarbonate (HCO₃).

Hisaralan Thermal Baths

It is 20 kms away from Sindirgi City center and in Hisaralan Village 500 m away from Simav-Sindirgi Road. Its heat is 84-90°C.

Emendere Thermal Baths

It is in Ilcali Village 8 kms away from Sindirgi. Its heat is 36°C.

Balya Ilica Thermal Baths

It is in Ilica County of Balya City. It is in 13th km in Balıkesir-Bandırma Highway and 22 kms away from Samli Road. Its water includes Sodium (Na), Calcium (Ca), chlorine (Cl), sulfates and carbonates.

Gonen Thermal Baths

The water of Gonen Thermal Baths is real thermal baths used by human for thousands of years. Water is drawn from 534 m depth and its heat is 82°C. There are a lot of substances in its water.

Gure Beldesi Thermal Baths

It is 12 kms away from Edremit. It is in Gure County on Edremit–Canakkale Highway. Its heat is 53°C. It includes potassium, ammonium, calcium, magnesium, iron, aluminum and hydrogen with free sulfur.

RUINS

Daskyleion Archaic City: After determining Daskyleion at 30 kms South of Bandırma, at the southeast of Birth Lake, at Hisartepe at 2 kms west of Ergili village, in 1954 Ekrem Akurgal started to excavations. He continued the excavation until 1960 and proved that Pers Satraplik Center was on Hisartepe by means of determining Xerxes name on some of the 500 bullas (seal) found in the area with archeological data.

Plakia Archaic City: It is an archaic settlement within the borders of Bandırma City.

Ataturk Park: Ataturk park that is behind Bandırma Port, in Erdek Road known by the local people as Ataturk Garden. It is a green and forestry place where people of Bandırma visit and have a picnic. Ataturk park is outside the city. Bandırma rapidly develops on the way to become an industrial city. For that reason plantation around the city could not be protected well.

Haydar Cavus Mosque: This mosque has a single dome and square plan. It was constructed by Haydar Cavus at the beginning of 19th century. The mosque burned in 1873 and re-built in neo-classical style.

Coastal Tourism

Balıkesir Province has coasts in two seas. In Balıkesir Province with Marmara and Aegean Islands there is intense seasonal tourism activity and sea tourism in summer months.

On the coasts of Kapıdağ looking at Bandırma there are a lot of natural and wide beaches. The beaches found in Kocakum and Tanaca Location are famous.

IV.2.11 Forestry Areas (Amounts of forestry areas, tree species and amounts in those areas, Sizes of coverage areas, closeness and characteristics, current and planned protection and/or use purposes, if the area of project is not a forest area the distance of the project and units to the closest forest area, Map with 1/25.000 scale)

Ecologic Structure of Forests

Amount of forestry area of Balıkesir Province is 669.701 ha and this amount consists of approximately 46 % of the total area. 345.415 ha, that is, 52 % of the forest area is productive forest area. Generally, it is within the borders of Marmara Region and Aegean Region, geographically. It is surrounded by Marmara Sea and Kazdağları at the north, Aegean Sea at the west, Manisa and İzmir Provinces at the south and Bursa and Kutahya Provinces at the east. Because of geographical position it has characteristics of marine and terrestrial climates. In the Aegean Sea sections the summers are hot and dry, winters are warm and rainy and shows characteristics of Mediterranean Sea climate. In the coasts of Marmara Sea summers are relatively cooler because of the effect of Black Sea climate. Moving to the interior sections, the climate turns into characteristics of terrestrial climate and the winters become colder. Yearly average precipitation is 612 mm. Forest inventory of Balıkesir Province is on the below table:

Forest Inventory of Balıkesir Province

Table IV-39. Distribution of forests of Balıkesir Province in accordance with species of trees, manner of ownership and manner of operation

		Type of tree	Productive Land (ha)	Disordered land (ha)	Total land (ha)
STATE FORESTS	Natural-Half natural Forests	With needles	204,889	55,277	260.166
		With leaves	77,663	186,200	263.863
		Mixed forests	22,676	81,757	104.433
		Total	305,228	323,234	628.462
	Plantations	With needles	36,715	1,052	37.767
		With leaves	1,555	-	1.555
		Mixed forests	1,917	-	1.917
		Total	40,187	1,052	41.239
	TOTAL		345.415	324,286	669,701
	PRIVATE FORESTS	Natural-Half natural Forests	With needles	4	2
With leaves			-	4	4
Mixed forests			-	-	-
Total			4	6	10
Plantations		With needles	160	-	160
		With leaves	-	-	-
		Mixed forests	-	-	-
		Total	160	-	160
TOTAL		164	6	170	

		Type of tree	Productive Land (ha)	Disordered land (ha)	Total land (ha)
TOTAL FORESTS	Natural-Half natural Forests	With needles	204,893	55,279	260.272
		With leaves	77,663	186,204	263.867
		Mixed forests	22,676	81,757	104.433
		Total	305,232	323,240	628.472
	TOTAL FORESTS Plantations	With needles	36,875	1,052	37.927
		With leaves	1,555	-	1.555
		Mixed forests	1,917	-	1.917
		Total	40,347	1,052	41.399
	TOTAL		345.579	324,292	669,871

Flora consists of forests including trees with leaves at the north, and trees with needle leaves at the other places and maki replaces at the parts close to sea. The most important tree specie is black pine. Kazdag goknar tree can be counted among endemic plants.

The closest forest area is located 2 km east of Project Site. Annex 15 includes Forest Map (Amanagement) procured from the General Directorate of Forest.

In the view obtained from Bandirma Forest Operation Directorate it was said, "Because there is no forest area in the place where power plant would be there in no problem to construct the power plant". The view of Bandirma Forest Operation Directorate is given in Annex-16.

Table IV-40. Primary forest products produced and submitted to use for state forests operated by Regional Forest Directorate of Balıkesir Province in last 10 years

TYPE OF PRODUCT	Years									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Log (m ³)	141.000	150.000	143.500	136.400	161.200	169.100	134.000	241.064	136.000	145.400
Wire Pole (m ³)	11.800	6.000	6.000	2.900	7.400	11.200	9.800	723	3.600	2.900
Mine Pole (m ³)	24.400	25.900	23.200	29.600	26.500	21.200	17.200	53.985	18.600	15.400
Industrial wood (m ³)	23.300	37.000	21.100	25.700	26.900	26.300	22.500	25.569	35.700	31.600
Wood for paper (m ³)	72.500	64.500	59.000	85.700	94.500	81.200	86.300	88.570	83.700	79.800
Wood Total (m ³)	273.000	283.400	252.800	280.300	316.500	309.000	269.800	409.911	277.900	275.100
Fiber- Chip wood	85.400	129.600	68.500	72.500	64.800	64.700	34.200	128.700	179.900	151.100
Pole	1.300	1.100	1.500	600	300	200	200	269	100	200
Industrial Wood total (m ³)	338.100	381.300	305.300	335.000	365.300	357.700	295.400	506.443	412.900	388.500
Wood production for burning	204.400	193.000	193.300	179.600	179.600	213.700	202.700	338.983	259.300	195.000

Benefits of forest existence

Forestry activities in Balıkesir Province started in 1940s and reached today by planning. Forestry of Balıkesir has an important role in Turkey Forestry from the point of view either working principles or forestry techniques.

Generally the technical and biologic characteristics of forestry areas of Balıkesir Province are in good quality. Especially because wood obtained from black pine forests in Dursunbey and Bigadic are very good quality from the point of view of technical characteristics it is searched and preferred forest product in Turkey.

An important amount of employment is provided from forestry activities for most of the people especially in villages far away from sea in Edremit city and in Dursunbey, Bigadic and Sındırgı zones.

Generally in Balıkesir Province forestry sector has great importance economically, socially and ecologically. Different economic forestry activities counted here have a lot of benefits for the society directly.

Forestry sector creates a great deal of employment potential especially in summer months. Additionally all forestry activities such as road, constructions, national park working etc make a big contribution to Balıkesir economy. Also indirect economic benefits of forestry sector are important as well as direct economic contribution.

There is a large employment capacity in Balıkesir Province because there are purchasers, sellers and processors of forest products.

Because forest areas in Balıkesir Province is wide spread there are dialogs among citizens about protectionism and forest awareness. Especially recently the understanding of citizens about protecting the forest and supporting forestation activities have developed a lot.

forests are the most important renewable sources of our country because they provide natural balance, prevent air pollution, arrange water regime, affect climate structure and prevent erosion in addition to meeting our demands for forest products.

Areas other than agriculture, grass and meadow and forest area are 53.844 ha and cover 4% of the total area.

IV.2.12 Flora and Fauna (species, endemic species, Species of wild life and biotopes, species protected by national and international legislation, rare and endangered species and their locations, , hunting animals and their populations and habitat), displaying vegetation types in project site on a map, mitigation measures for the protection of affected species from project activities, (in the construction and operation phases), realization of field study on vegetation period and specifying this period

Project site is in Marmara Region, Balıkesir Province, Bandırma District, Sirincavus Village, Hacılibey Location.

Vegetation

Project Site is at the region which displays a transitional characteristics between Europe-Siberia and Mediterranean Fitogeography Region.

Those places that have the characteristics of Mediterranean Sea Region and generally that are found in coastal areas are cooler than the Mediterranean Sea Region. Maki elements are dominant in flora. Additionally there are oak species in this belt different from Mediterranean Sea Region. Most of the flora have characteristics that can endure the dryness of the summer. But they are sensitive to lower temperatures. Generally in this belt spreading until 400 hundred meters height, oak species that pour their leaves are dominant. Other that those species there are *Cercis siliquastrum*, *Laurus nobilis*, *Erica arborea*, *Cistus salviifolius*, *Pistacia lentiscus*, *Olea europea*, Oleaster that are the characteristics of Mediterranean Sea Region plants.

Europe-Siberia Fitogeography Zone covers the area out of Gelibolu and Biga Peninsulas in Black Sea Region and in Marmara Sea Region where Black Sea climate is effective. Hillsides of mountain series roughly lengthening east-west direction looking at north direction form the southern border of region in Black Sea Region and in Marmara Sea Region. But in this zone there are tectonic formations and reservoirs between hillsides looking at south direction and mountains that form different environments. Vegetation formation of Black Sea Region flora is given in Figure IV-24. When considering from the point of view of grid system of P.H. Davis (Flora of Turkey and The East Aegean Islands) Project Site lies in A-1 square.

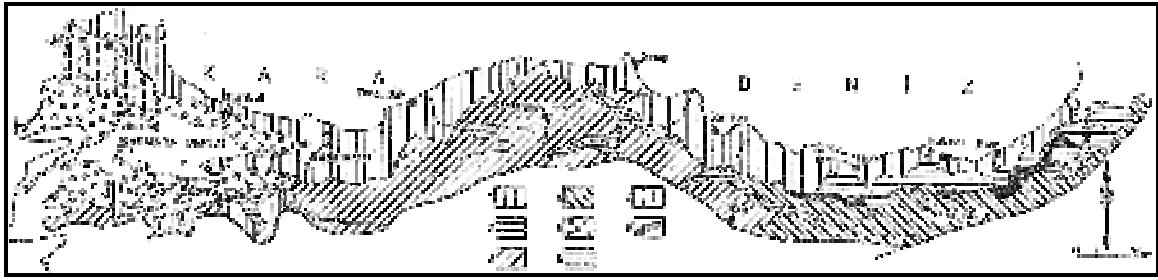


Figure IV-24. Vegetation formations of Black Sea flora zone

(1. Birsch, oak, red tree, linden tree, chestnut tree forests that pour their leaves in wet cool climate. 2. Spruce forests in Black Sea Region. 3. Black pine, goknar and yellow pine forests with needle leaves mostly 4. Dry forest with needle and white leaves. 5. Dry forest consisting of red pine and oak, 6. Dry forest consisting of bushes and red pines coming from Mediterranean Sea Region, 7. Anthropogenic step, 8. Alpine grass)

At the areas out of depressions of Ergene Reservoir and Black Sea Region wet and very wet climatic conditions are dominant. Precipitation is observed in every season although amount of it is not equally distributed. In summer, the north hillsides of the zone are generally misty. This mist decrease suffering of flora from lack of water in South Marmara that is relatively dry. Most of the flora displays of hygrophyte and hydrofoil characteristics. On the areas extending up to 1000 m height there are forests (such as birsch, chestnut tree, red tree and oak forests) that pour their leaves in wet and cool winter when the yearly average temperature changes between 10-14 °C and there is forest belt (spruce, goknar and yellow pine belts) between 1000-1200 m in the region where the yearly average temperature changes between 6-10 °C.

The probable types of vegetation at the project Site and its vicinity are as follows:

Litoral Rock Vegetation: It is a kind of vegetation found in primary rock in ebb and flood zone in the coastal areas or especially that complies with the conditions of extreme environment on sandstone blocks on dune areas. The most typical plant specie spreading on those areas is *Crithmum maritimum*. *Limonium gmelinii* is found together with this specie in rock gaps and crack under the effect of sea. Other characteristics species seen on litoral rocks are *Mesembryanthemum nodiflorum* and *Frankenia hirsuta*.

River bed and Marshy Vegetation: This type vegetations are extensively seen on river beds, surroundings of irrigation and drainage canals and fresh water covering flood areas of those systems. Dominant specie seen reed and rush areas covering the entire river bed is *Pragmatism austral is*. Within this cover there are *Type latifolia*, *Schoenoplectus lacustris*, *Polypogon monspeliensis*, *Iris pseudocorus* and *Cyperus* and *Carex* species.

Synantropik Vegetation: Transformation, in other words succession continuing in natural and natural like changes its character because of external effects made to the system. Transformation arising from the effect of using different areas shows itself as degradation.

In settlement areas as a result of different anthropogenic effects the plant species that have complied with changing life conditions are called “synantropik species”. This type of vegetation is mostly found at the edge of walls, in the gaps of buildings, in cesspools, on debris, on fences and on borders of field mostly on the areas that are rich in nitrogen.

This type that generally includes the cosmopolite species of *Chenopodiaceae*, *Solanaceae*, *Brassicaceae* and *Urticaceae* family are widely spread on the destroyed areas. On those type of areas where the environmental conditions change as a result of anthropogenic effects and ruderal vegetation having a big variety of habitat and association are put together in the class of *Chenopodietea*. The species of *Chenopodietea* class are as follows (Yilmaz, 1993 and Oberdorfer 1957).

Plants an edge of road	:	<i>Malvo-Carduetalia</i>
Plants on dry cesspools	:	<i>Atriplicetalia-Roseae</i>
Plants on shadowed wall	:	<i>Urticetalia-Urentis</i>
Not used vegetable gardens	:	<i>Chenopodietalia-Aquifolii</i>

The primary representatives of those plant species in coastal belt of Eastern Black Sea Region where the Project Site is included are *Malva neglecta*, *Malva parviflora*, *Carduus pycnocephalus*, *Atriplex hastata*, *Urtica urens*, *Chenopodium album* and *Chenopodium murale*.

In the Project Site where natural flora has been completely removed *Centaurea calcitrapa*, *Xanthium strumarium* ve *Daucus guttatus* species in ruderal vegetation are dominant in the gaps in structures, open storing areas and in edges of road. On the beach, in approximately 20 m width between operation area and sea, typical preliminary dune species such as *Cakile maritima* and *Salsola kali* are not frequent.

Flora

When it is considered in the view of the grid system of P.H. Davis (Flora of Turkey and The East Aegean Islands), Project Site is in A-1 square in Mysia Region.

Flora of Project Site and its close vicinity is given in Figure IV-25.



Figure IV-25. Flora of Project Site and its close vicinity

In order to determine the flora of the Project Site and its close vicinity *Biologists* Esra Elif AYDIN and *Landscape Architect* Ozgur TUGCU carried out a site observation in November 2007. Inventory tables are formed showing habitats of determined flora elements, fitogeographic regions, relative abundances, endemism states and national and international protection states by supporting data of made site and literature survey. It was determined 73 plant species that were or probably were in the area as a result of those studies. 3 of those plants are Iran-Turan, 21 of those species are Eastern Mediterranean element, 21 of them are Mediterranean element and 38 of them are cosmopolite species whose fitogeographic regions are not known.

Endemic plants determined in the area are *Carex divulsa* subsp. *Coriogyne* species. during the literature survey, it was determined that this specie is spread in Aegean, Middle Anatolia, Mediterranean Sea and Eastern Anatolia Regions. When studying endemic species of the region in view of IUCN categories, it was determined that all of them were “Least Concern” (LC) category. LC category is used for the plant species that are not under risk and that grew a lot in Turkey. Additionally no plant that is under protection within the scope of Protection Agreement of Wild Life and Their Living Environment (Bern Agreement) is detected at the Project Site.

Table IV-41. Flora

Species No	Species	Fitogeographic Zone	Habitat	Relative Abundance	Endemism	Bern	Risk Class	Determination manner
	Apiaceae – Parsley Family							
1	<i>Ammi majus</i>	Medd.	5	3	D	-	-	G
2	<i>Anthriscus nemorosa</i>	-	6	3	D	-	-	L
3	<i>Daucus carota</i>	-	5	3	D	-	-	L
	Araceae – Cucko pint family							
4	<i>Arum elongatum</i> subsp. <i>Elongatum</i>	-	5	2	D	-	-	L
5	<i>Dracunculus vulgaris</i>	E. Medd.	6	2	D	-	-	G
	Araliaceae – Hedera helix family							
6	<i>Hedera helix</i>	-	2	3	D	-	-	L
	Asclepiadaceae							
7	<i>Cynanchum acutum</i> subsp. <i>acutum</i>	-	6	2	D	-	-	L
8	<i>Periploca graeca</i> var. <i>graeca</i>	E. Medd.	2	2	D	-	-	L
	Asteraceae – Daisy family							
9	<i>Anthemis auriculata</i>	E. Medd.	4	2	D	-	-	L
10	<i>Anthemis tinctoria</i> var. <i>tinctoria</i>	-	5	2	D	-	-	L
11	<i>Artemisia santonicum</i>	Eur.-Sib.	5	3	D	-	-	L
12	<i>Calendula arvensis</i>	-	7,8	2	D	-	-	L
13	<i>Centaurea solstitialis</i> subsp. <i>solstitialis</i>	-	7	2	D	-	-	L
14	<i>Centaurea thracica</i>	-	5	2	D	-	-	L
15	<i>Crepis foetida</i> subsp. <i>commutata</i>	-	3	2	D	-	-	L
16	<i>Echinops ritro</i>	-	5	2	D	-	-	G
17	<i>Jurinea consanguinea</i>	-	5	2	D	-	-	L
18	<i>Pilosella piloselloides</i> subsp. <i>piloselloides</i>	-	2	2	D	-	-	L
	Boraginaceae – Borretsch family							
19	<i>Cynoglossum montanum</i>	Eur.-Sib.	2	3	D	-	-	L
20	<i>Echium italicum</i>	Medd.	5	3	D	-	-	G
	Brassicaceae – Radish Family							
21	<i>Thlaspi perfoliatum</i>	-	5	3	D	-	-	L
	Caryophyllaceae – carnation family							
22	<i>Moenchia mantica</i> subsp. <i>mantica</i>	-	6	2	D	-	-	L
23	<i>Silene compacta</i>	-	8	2	D	-	-	L
24	<i>Silene vulgaris</i> var. <i>vulgaris</i>	-	5	2	D	-	-	L
	Convolvulus – Ivy family							
25	<i>Convolvulus arvensis</i>	-	5	3	D	-	-	G
	Cyperaceae – Papyrus family							
26	<i>Carex divulsa</i> subsp. <i>coriogyne</i>	E. Medd.	5	3	Y	-	LC	L
27	<i>Carex flacca</i> subsp. <i>serrulata</i>	Medd.	6	3	D	-	-	L
	Elaeagnaceae – Oleaster family							
28	<i>Elaeagnus angustifolia</i>	-	6	1	D	-	-	L
	Ericaceae – Brush family							
29	<i>Erica arborea</i>	-	2	2	D	-	-	G
30	<i>Monotropa hypopithys</i>	-	6	1	D	-	-	L
	Euphorbiaceae – Euphorbia Family							
31	<i>Euphorbia falcata</i> subsp. <i>macrostegia</i>	-	6	2	D	-	-	L
	Fabaceae – Leguminous seeds							
32	<i>Anthyllis tetraphylla</i>	Medd.	8	3	D	-	-	L
33	<i>Astragalus trojanus</i>	E. Medd.	2	3	D	-	-	L
34	<i>Chamaecytisus hirsutus</i>	-	5	2	D	-	-	L

35	<i>Gonocytisus angulatus</i>	E. Medd.	2	2	D	-	-	L
	Fagaceae – Beech family							
36	<i>Quercus frainetto</i>	Eur.-Sib.	2	3	D	-	-	G
	Gentianaceae							
37	<i>Centaurium erythraea</i> subsp. <i>turcicum</i>	-	6	1	D	-	-	L
	Lamiaceae – Dead nettle family							
38	<i>Calamintha nepeta</i> subsp. <i>glandulosa</i>	-	6	3	D	-	-	L
39	<i>Micromeria myrtifolia</i>	E. Medd.	3	3	D	-	-	G
40	<i>Nepeta italica</i>	-	3	3	D	-	-	L
41	<i>Nepeta nuda</i> subsp. <i>Albiflora</i>	Ir.-Tur.	5	2	D	-	-	L
42	<i>Prunella vulgaris</i>	Eur.-Sib.	5	3	D	-	-	L
43	<i>Thymus sipyleus</i> subsp. <i>sipyleus</i> var. <i>sipyleus</i>	-	8	3	D	-	-	L
	Liliaceae – Lily family							
44	<i>Allium amethystinum</i>	Medd.	2	2	D	-	-	L
45	<i>Gagea chrysantha</i>	Medd.	2	2	D	-	-	L
	Linaceae – Linen family							
46	<i>Linum trigynum</i>	Medd.	8	3	D	-	-	L
	Oleaceae – Olive family							
47	<i>Jasminum fruticans</i>	Medd.	5	2	D	-	-	L
48	<i>Olea europaea</i> var. <i>syvestris</i>	Medd.	2	2	D	-	-	G
49	<i>Phillyrea latifolia</i>	Medd.	2	2	D	-	-	G
	Orchidaceae – Orchis family							
50	<i>Limodorum abortivum</i>	-	2	2	D	-	-	L
51	<i>Ophrys fusca</i>	Medd.	8	2	D	-	-	L
	Plantaginaceae – Hoart plantain family							
52	<i>Plantago lanceolata</i>	-	2	3	D	-	-	L
	Plumbaginaceae – Ammi majus family							
53	<i>Goniolimon incanum</i>	E. Medd.	2	2	D	-	-	L
54	<i>Plumbago europaea</i>	Eur.-Sib.	5	3	D	-	-	L
	Poaceae – Wheat family							
55	<i>Arrhenatherum elatius</i> subsp. <i>Elatius</i>	Eur.-Sib.	8	3	D	-	-	L
56	<i>Bromus intermedius</i>	-	7	3	D	-	-	G
57	<i>Cynodon dactylon</i> var. <i>dactylon</i>	-	5	3	D	-	-	G
58	<i>Eragrostis cilianensis</i>	-	5	3	D	-	-	L
59	<i>Phleum exaratum</i> subsp. <i>exaratum</i>	-	5	3	D	-	-	L
60	<i>Piptatherum coerulescens</i>	-	8	3	D	-	-	L
61	<i>Psilurus incurvus</i>	-	2	3	D	-	-	L
62	<i>Ventenata subenervis</i>	E. Medd.	5	3	D	-	-	L
63	<i>Vulpia ciliata</i> subsp. <i>Ciliata</i>	-	7	4	D	-	-	L
64	<i>Vulpia myuros</i>	-	2	3	D	-	-	L
	Ranunculaceae – Ranunculus viridis family							
65	<i>Nigella elata</i>	-	7	2	D	-	-	L
66	<i>Ranunculus illyricus</i> subsp. <i>illyricus</i>	-	5	2	D	-	-	L
	Rosaceae – Rose family							
67	<i>Filipendula vulgaris</i>	Eur.-Sib.	5	2	D	-	-	L
68	<i>Geum urbanum</i>	Eur.-Sib.	6	2	D	-	-	L
69	<i>Potentilla micrantha</i>	-	6	3	D	-	-	L
70	<i>Pyrus amygdaliformis</i> var. <i>amygdaliformis</i>	E. Medd.	2	1	D	-	-	L
	Rubiaceae – Purpirin family							
71	<i>Asperula involucrata</i>	Eur.-Sib.	1	2	D	-	-	L
	Saxifragaceae							

72	<i>Saxifraga sibirica</i> subsp. <i>mollis</i>	-	6	2	D	-	-	L
	Scrophulariaceae – Siracaotu family							
73	<i>Verbascum lasianthum</i>	-	5	2	D	-	-	L
	Valerianaceae – Valerian family							
74	<i>Valerianella discoidea</i>	Medd..	8	2	D	-	-	L

Abbreviations		
Habitat	Risk Classes (IUCN)	Source
1. Forest, forest opening and forest edges	RE (Regionally extinct)	L - Literature
2. Maki	CR (Critically endangered)	G - Observation
3. Frigana (most of them are with prick, short and pillow forming plants)	EN (Endangered)	D - Sensation
4. Culture areas (Vineyard, garden etc) left places	VU (Vulnerable)	
5. Dry grass and open areas	NT (Near threatened)	
6. Wet grass , marshy and wet areas slope with plant	LC (Least concern)	
7. Road edge, left places	DD (Data deficient)	
8. Rocky and stony areas, places with shadow, slope with limestone	NA (Not applicable)	
	NE (Not evaluated)	
Relative Abundance	Fitogeographic Region	Endemism State
1. Very rare	Akd. – Mediterranean Sea element	D – Not Endemic
2. Rare	D. Akd. – Eastern Mediterranean Sea Element	Y - Spread Endemic
3. Moderate abundance (Relativeli abundant)	İr.-Tur. – İran-Turan Element	B – Regional Endemic
4. Abundant	Av.-Sib. – Europe – Siberia Element	L - Local Endemic
5. A lot of	(-) – Wide Spread or unknown	
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http://www.tubitak.gov.tr/tubives/index.php (Turkish Plants Data Service - TUBITAK)		

In order to determine plant species that are endemic and endangered, "Red Data Book of Turkish Plants (Turkey Nature Protection Association and 100th Year University of Van 2000) and <http://bioces.tubitak.gov.tr> web site prepared by Tubitak is scanned and any endangered plant species are not encountered. Endemic plants shown in G-Flora Table are the species determined as a result of literature survey.

Fauna

As is known, the vertebrate fauna is classified under 4 main categories systematically. These are Amphibian, Reptiles, Birds and Mammals. Within the scope of the EIA studies conducted within the Project Site and in the vicinity, fauna of the region determined by literature survey.

In order to identify the species that are under protection among the species specified below, the Turkish Environmental Legislation, the European Wildlife and Habitats Protection Agreement (Bern Agreement) and its Appendices and "Species List in Red Data Book" prepared by Kiziroglu (1989) and Demirsoy (2002) "General Zoogeography and Zoogeography of Turkey" have been reviewed. At the end of the studies, the inventory tables demonstrating the habitats, population densities, national and international protection status of the fauna elements found in this area have been established. The hazard grades and the protection status related to these have been identified according to the Additional Lists under the Bern Agreement (Annex – 2: strictly protected fauna species, Annex – 3: protected fauna species) and ERL (European Red List) and Red Data Book arranged by IUCN (the International Nature Protection Association).

In addition to these, for the animal species such as birds, reptiles and mammals, the lists of the "2007-2008 Hunting Season Central Hunting Commission Decisions" Annex – I (Wild Animals protected by the MoEF), Annex -II (Game animals protected by the Central Hunting Commission) and Annex -III (Game animals permitted to be hunted for the certain periods of time by the Central Hunting Commission) coming into force by being issued on the Official Gazette dated 06.07.2007 no. 26574 by the Republic of Turkey the MoEF Nature Protection and National Parks General Directorate have been processed into the relevant tables. The wild animals included in the list of the Annex-I have been taken under protection by the MoEF in accordance with the first paragraph of the article 4 of the Hunting Act no 4915. It is forbidden to hunt, to have as dead or alive and to transport the wild animals included in this list. The birds and mammals included in the list of the Annex-II have been taken under protection by the Central Hunting Commission under the authorization issued by the first paragraph of the article 4 of the Hunting Act no 4915. It is forbidden to hunt, to have as dead or alive and to transport the game animals included in this list. The game animals included in the list of the Annex-III are the game animals which are permitted to be hunted by the Central Hunting Commission for the periods specified in the hunting season of 2007-2008 periods determined by the MoEF in accordance with the first paragraph of the article 4 of the Hunting Act no 4915.

As a result of the studies performed, no endemic species are encountered at the Project Site and its vicinity. Moreover, there are no sensitive areas for breeding, nesting and migration for the fauna species.

Birds

16 of the 29 species of birds which exist or have the possibility of existence at the Project Site and its vicinity are included in the Bern Agreement Annex-2 and 7 of them are included in the Bern Agreement Annex-3. According to the final lists on which the "2007-2008 Hunting Season Central Hunting Commission Decisions" coming into force by being issued on the Official Gazette dated 06.07.2007 no. 26574 by the Republic of

Turkey the MoEF Nature Protection and National Parks General Directorate have been reflected; 18 species of birds are included in the list of the Annex-I of “Wild Animals protected by the MoEF”, 4 species of birds are included in the list of the Annex-II of “Game animals protected by the Central Hunting Commission”; 7 species of birds are included in the list of the Annex-III of “Game animals permitted to be hunted for the certain periods of time by the Central Hunting Commission”.

Table IV-42. Birds

Latin Name	Turkish Name	English Name	Habitat	Population Density	IUCN	RDB	Bern	AVL	Status	Endemism Status	Source
Ordo: Accipitriformes	Accipitriformes										
Fam: Accipitridae	Accipitridae										
Sp: <i>Buteo buteo</i>	Buzzard	Buzzard	St, DK	-	A, V	A-4	A-III	A-I	Y, KZ, T	-	
Ordo: Falconiformes	Falconiformes										
Fam: Falconidae	Falconidae										
Sp: <i>Falco tinnunculus</i>	Kestrel	Kestrel	CB, St	-	V	A-4	A-II	A-I	Y	-	
Ordo: Galliformes	Galliformes										
Fam: Phasianidae	Phasianidae										
Sp: <i>Coturnix coturnix</i>	Quail	Quail	CB, St	-	V	A-4	A-III	A-III	G, Y	-	
Ordo: Columbiformes	Columbiformes										
Fam: Colubidae	Colubidae										
Sp: <i>Columba livia</i>	Rock Dove	Rock Dove	DK, St, CB	-	-	A-4	A-III	A-III	Y	-	
Sp: <i>Streptopelia decaocto</i>	Collared Dove	Collared Dove	CB	-	-	A-4	A-III	A-II	Y	-	
Ordo: Apodiformes	Apodiformes										
Fam: Apodidae	Apodidae										
Sp: <i>Apus apus</i>	Swift	Swift	St, CB	-	V	A-4	A-III	A-I	G, T	-	
Sp: <i>Apus melba</i>	Alpine Swift	Alpine Swift	St, CB, DK	-	V	A-4	A-II	A-I	G, T	-	
Ordo: Coraciiformes	Coraciiformes										
Fam: Meropidae	Meropidae										
Sp: <i>Merops apiaster</i>	Bee-Eater	Bee-Eater	St, CB	-	V	A-4	A-II	A-I	G	-	
Ordo: Passeriformes	Passeriformes										
Fam: Alaudidae	Alaudidae										
Sp: <i>Melanocorypha leucoptera</i>	White-Winged Lark	White-Winged Lark	St, CB	-	O	-	A-II	A-I	G	-	
Fam: Hirundinidae	Hirundinidae										
Sp: <i>Hirundo rustica</i>	Swallow	Swallow	CB	-	O	-	A-II	A-I	G	-	
Sp: <i>Hirundo daurica</i>	Red-Rumped Swallow	Red-Rumped Swallow	CB	-	O	-	A-II	A-I	G, T	-	
Sp: <i>Riparia riparia</i>	Sand Martin	Sand Martin	St, CB	-	O	-	A-II	A-I	G	-	
Fam: Motacillidae	Motacillidae										
Sp: <i>Anthus pratensis</i>	Meadow Pipit	Meadow	St	-	-	-	A-II	A-I	G, T	-	

Latin Name	Turkish Name	English Name	Habitat	Population Density	IUCN	RDB	Bern	AVL	Status	Endemism Status	Source
		Pipit							KZ		
Sp: <i>Anthus cervinus</i>	Red-Thorated Pipit	Red-Thorated Pipit	St	-	-	-	A-II	A-I	T, KZ	-	
Sp: <i>Anthus spinoletta</i>	Water Pipit	Water Pipit	St	-	V	A-4	A-II	A-I	Y, KZ	-	
Fam: <i>Turdidae</i>	Turdidae										
Sp: <i>Oenanthe hispanica</i>	Black-Eared Wheatear	Black-Eared Wheatear	St, DK	-	O	-	A-II	A-I	G, T	-	
Sp: <i>Oenanthe finschii</i>	Finsch's Wheatear	Finsch's Wheatear	St	-	O	-	A-II	A-I	G	-	
Sp: <i>Oenanthe deserti</i>	Desert Wheatear	Desert Wheatear	St	-	O	-	A-III	A-II	T	-	
Fam: <i>Corvidae</i>	Corvidae										
Sp: <i>Pica pica</i>	Magpie	Magpie	CB, St	-	O	-	-	A-III	Y	-	
Sp: <i>Corvus monedula</i>	Jackdaw	Jackdaw	CB, St	-	O	-	-	A-III	Y	-	
Sp: <i>Corvus frugilegus</i>	Rook	Rook	St, CB	-	O	-	-	A-III	Y, KZ	-	
Sp: <i>Corvus corone cornix</i>	Carrion Crow	Carrion Crow	St, CB	-	O	-	-	A-III	Y	-	
Fam: <i>Sturnidae</i>	Sturnidae										
Sp: <i>Sturnus vulgaris</i>	Starling	Starling	CB, St	-	O	-	-	A-II	Y	-	
Sp: <i>Sturnus roseus</i>	Rose-Coloured Starling	Rose-Coloured Starling	CB, St	-	-	-	A-II	A-I	G	-	
Fam: <i>Passeridae</i>	Passeridae										
Sp: <i>Passer domesticus</i>	House Sparrow	House Sparrow	CB	-	O	-	-	A-III	Y	-	
Fam: <i>Emberizidae</i>	Emberizidae										
Sp: <i>Emberiza citrinella</i>	Yellowhammer	Yellowhammer	CB	-	O	-	A-II	A-I	KZ, T	-	
Sp: <i>Emberiza cirius</i>	Cirl Bunting	Cirl Bunting	CB	-	O	-	A-II	A-I	KZ, T	-	
Sp: <i>Emberiza caesia</i>	Cretzschmar's Bunting	Cretzschmar's Bunting	CB	-	O	-	A-II	A-I	G	-	
Sp: <i>Emberiza bruniceps</i>	Red-Headed Bunting	Red-Headed Bunting	CB	-	O	-	A-III	A-II	G	-	

Abbreviations		
Habitat	Hazards Grades (IUCN)	Status
ST - Step	EX - Extinct	Y - Domestic
Or - Forest	E - Endangered	G - Migratory
SA - Wetland	V - Vulnerable	T - Transit
Dn - Sea	R - Rare	KZ - Winter visitor
DK - Mountainous and Rocky	I - Unknown	BG - Intersectional migration
CB - Bush and	K - Insufficiently known	YG - Altitude migratory

Garden		
	O - Out of danger	
2007-2008 Central Hunting Commission Decisions (AVL)		Source
Annex -I : Wild Animals protected by the MoEF		L - Literature
Annex -II : Game animals protected by the Central Hunting Commission		G - Observation
Annex -III : Game animals permitted to be hunted for the certain periods of time by the Central Hunting Commission		D - Speculation
Endangered Bird Categories According to the Red Data Book (RDB)		
A-1 : Extinct or endangered species		
A-1-2 : Species struggling to survive in small populations (1-25 pairs)		
A-2 : Endangered species in their habitats (26-50 pairs)		
A-3 : Rare species in certain lands (51-500 pairs)		
A-4 : Species that might be endangered in the lands where they are becoming extinct (501-5000 pairs)		
A-1' : Species using Turkey as winter quarters, not breeding and immediate endangered		
A-2' and A-3' : Species not breeding in Turkey, coming to our country temporarily and migrating in transit or spending the winter		
European Wildlife and Habitat Protection Agreement (Bern)		
Annex II : (SPFS; Strictly Protected Fauna Species)		
Annex III : (PFS; Protected Fauna Species)		
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Amfibia

Amfibia are the organisms that need at least two different habitats as one of them to be water in order to accomplish their life cycles. Such type of habitats are the large or small scale stagnant pools such as lake or pond but not becoming dry for a long period of time; coasts of the rivers; especially the temporary or permanent flood ponds occurred by the rivers at their sides; under the large stones in such types of habitats, tree holes or immediate area of their roots or the forests or woodlands often receiving rain. There are the species of amfibia which are active at night as well as the ones which are active in day.

2 of the 6 species of amfibia which exist or have the possibility of existence at the Project Site and its vicinity are included in the Bern Agreement Annex-2 and 4 of them are included in the Bern Agreement Annex-3.

Table IV-43. Amphibia

Species No	Latin Name	Turkish Name	Habitat	Population Density	IUCN	ERL	Bern	Endemism Status	Source
	Classis: Amphibia	Amphibia							
	Ordo: Urodela	Urodela							
	Subordo: Salamandroidea	Salamandroidea							
	Fam: Salamandridae	Salamandridae							
1	Subsp: <i>Triturus vulgaris vulgaris</i>	Triturus	In the waters still or flowing slow	2	nt	nt	A-III	-	L
2	Sp: <i>Triturus vittatus ophryticus</i>	Triturus vittatus ophryticus	In the cold waters still or flowing slow		nt	nt	A-III	-	L
	Ordo: Anura	Anura							
	Subordo: Anomocoela								
	Fam: Pelobatidae	Pelobatidae							
3	Sp: <i>Pelobates syriacus</i>	Eastern Spadefoot	In the mellow lands near the stagnant pools	2	nt	nt	A-II	-	L
	Subordo: Procoela								
	Fam: Bufonidae	Bufonidae							
4	Sp: <i>Bufo bufo bufo</i>	European Toad	Under the humid stones in the lands having less plants or woody	3	nt	nt	A-III	-	D
5	Sp: <i>Bufo viridis</i>	Bufo Viridis	In the gardens, in the open stony lands, near the water	3	nt	nt	A-II	-	L
	Subordo: Diplasiocaela								
	Fam: Ranidae								
6	Subsp: <i>Rana ridibunda ridibunda</i>	Marsh Frog	In the lower plains, pools and stagnant pools having plenty of plants	3	nt	nt	A-III	-	L

Abbreviations	
Hazard Grades (IUCN)	Source
EX - Extinct	L - Literature
E - Endangered	G - Observation
V - Vulnerable	D - Speculation
R - Rare	Population Density
I - Unknown	3 - Prodigious
K - Insufficiently known	2 - Plenty
O - Out of danger	1 - Rare
nt - Widespread, plenty, in the clear	0 - None
European Wildlife and Habitat Protection Agreement (Bern)	
Annex II : (SPFS; Strictly Protected Fauna Species)	
Annex III : (PFS; Protected Fauna Species)	
2007-200 Central Hunting Commission Decisions (AVL)	
Annex -I : Wild Animals protected by the MoEF	

Annex -II : Game animals protected by the Central Hunting Commission
Annex -III : Game animals permitted to be hunted for the certain periods of time by the Central Hunting Commission
Literature
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Reptiles

The species of reptiles live in the spaces between holes and roots of trees, in the stony areas, under the stones, within the plant waste and in the soil pits, in the water and at the waterfront. 9 of the 15 species of reptiles which exist and has a possibility of existence due to habitat conformity at the Project Site and its vicinity are included in the Bern Agreement Annex-2 and 6 of them are included in the Bern Agreement Annex-3.

All species of reptiles are included in the list of the Annex-I (Wild Animals protected by the MoEF) according to the final lists on which the "2007-2008 Hunting Season Central Hunting Commission Decisions" coming into force by being issued on the Official Gazette dated 06.07.2007 no. 26574 by the Republic of Turkey the MoEF Nature Protection and National Parks General Directorate have been reflected.

Table IV-44. Reptiles

Species No	Latin Name	Common Name	Habitat	Population Density	IUCN	ERL	Bern	AVL	Endemism Status	Source
	Classis: Reptilia	Reptilia								
	Subclassis: Anapsida									
	Ordo: Chelonia	Chelonia								
	Fam: Testudinidae									
1	Sp: Testudo graeca	Tortoise	Dry, stony and sandy lands, between vineyard-garden	1	nt	nt	A-II	A-I	-	D
	Subclassis: Lepidosauria	Lepidosauria								
	Ordo: Squamata	Squamata								
	Subordo: Lacertilia	Lacertilia								
	Fam: Anguidae	Anguidae								
2	Sp: Anguis fragilis	Snake Lizard	Under the stones in woody, macquis groves and bushy areas	1	nt	nt	A-III	A-I	-	L
3	Sp: Ophisaurus apodus thracicus	European Legless Lizard	Moors and stony areas	2	nt	nt	A-II	A-I	-	L

Species No	Latin Name	Common Name	Habitat	Population Density	IUCN	ERL	Bern	AVL	Endemism Status	Source
	Fam: Gekkonidae	Gekkonidae								
4	Sp: <i>Cyrtodactylus kotschy</i>	Cyrtopodion Kotschy	Stony regions having less plants	1	nt	nt	A-II	A-I	-	L
5	Subsp: <i>Hemidactylus turcicus turcicus</i>	Mediterranean House Gecko	Under the stones, between the rocks		nt	nt	A-III	A-I	-	L
	Fam: Lacertidae	Lacertidae								
6	Subsp: <i>Lacerta sicula hieroglyphica</i>	Istanbul Lizard	Rocky places and walls	1	nt	nt	A-II	A-I	-	L
7	Subsp: <i>Lacerta viridis meridionalis</i>	Small Green Lizard	Sunny open lands in woody and bushy areas	1	nt	nt	A-II	A-I	-	L
8	Subsp: <i>Ophisops elegans macrodactylus</i>	Ophisops elegans	Open lands having less plants and stony areas	2	nt	nt	A-II	A-I	-	L
	Fam: Scincidae	Scincidae								
9	Subsp: <i>Ablepharus kitaibelli kitaibelli</i>	European Copper Skink	Open lands and macquis groves having short plants	2	nt	nt	A-II	A-I	-	L
	Subordo: Ophidia	Ophidia								
	Fam: Boidae	Boidae								
10	Sp: <i>Eryx jaculus</i>	Eryx jaculus	Sandy and stony areas in dry places	2	nt	nt	A-III	A-I	-	L
11	Subsp: <i>Eryx jaculus turcicus</i>	Eryx jaculus	Sandy and stony areas in dry places	2	nt	nt	A-III	A-I	-	L
	Fam: Colubridae									
12	Sp: <i>Eirenis modestus</i>	Eirenis modestus	Stony regions having less plants	2	nt	nt	A-III	A-I	-	L
13	Subsp: <i>Elaphe quatuorlineata sauromates</i>	Yellow Snake	Rare woody, bushy and stony areas	2	nt	nt	A-II	A-I	-	L
14	Subsp: <i>Malpolon monspessulans insignita</i>	Malpolon monspessulans	Stony regions having less plants	1	nt	nt	A-III	A-I	-	L
15	Subsp: <i>Telescopus fallax fallax</i>	Cat Snake	Sunny and stony slopes road sides	1	nt	nt	A-II	A-I	-	L

Abbreviations	
Hazard Grades (IUCN)	Source
EX - Extinct	L - Literature
E - Endangered	G - Observation
V - Vulnerable	D - Speculation
R - Rare	Population Density
I - Unknown	3 - Prodigious
K - Insufficiently known	2 - Plenty
O - Out of danger	1 - Rare
nt - Widespread, plenty, in the clear	0 - None
European Wildlife and Habitat Protection Agreement (Bern)	
Annex II : (SPFS; Strictly Protected Fauna Species)	

Annex III : (PFS; Protected Fauna Species)
2007-2008 Central Hunting Commission Decisions (AVL)
Annex -I : Wild Animals protected by the MoEF
Annex -II : Game animals protected by the Central Hunting Commission
Annex -III : Game animals permitted to be hunted for the certain periods of time by the Central Hunting Commission
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Mammals

5 of the 14 species of reptiles which exist in the Project Site and have the possibility of existence due to the habitat conformity are included in the list of the Bern Agreement Annex-3. According to the final lists on which the "2007-2008 Hunting Season Central Hunting Commission Decisions" coming into force by being issued on the Official Gazette dated 06.07.2007 no. 26574 by the Republic of Turkey the MoEF General Directorate of Nature Protection and National Parks have been reflected; 3 species of mammals are included in the list of the Annex-I "Wild Animals protected by the MoEF", 2 species of mammals are included in the list of the Annex-II of "Game animals protected by the Central Hunting Commission"; 2 species of mammals are included in the list of the Annex-III of "Game animals permitted to be hunted for the certain periods of time by the Central Hunting Commission".

Table IV-45. Mammalia

Species No	Latin Name	Common Name	Habitat	Population Density	IUCN	ERL	Bern	AVL	Endemism Status	Source
	Classis: Mammalia	Mammalia								
	Ordo: Carnivora	Carnivora								
	Fam: Canidae	Canidae								
1	Sp: <i>Vulpes vulpes</i>	Vulpes vulpes	All kinds of habitat	2	nt	nt	-	A-III	-	D
	Fam: Mustelidae	Mustelidae								
2	Sp: <i>Mustela erminea</i>	Big Veasel	Forest, meadow, open areas, rocky areas, gardens	1	nt	nt	-	A-II	-	L
3	Sp: <i>Mustela nivalis</i>	Veasel	Forest, bush, rock, built-up areas and cultural lands	1	nt	nt	A-III	A-II	-	L
	Ordo: Insectivora	Insectivora								
	Fam: Erinaceidae	Erinaceidae								
4	Sp: <i>Erinaceus concolor</i>	Porcupine	Vineyard, garden, cultural lands and forest		nt	nt	-	A-I	-	D
	Fam: Soricidae	Soricidae								
5	Sp: <i>Crocidura leucodon</i>	Soricidae Vole	Open lands and bushy areas	1	nt	nt	A-III	-	-	L

Species No	Latin Name	Common Name	Habitat	Population Density	IUCN	ERL	Bern	AVL	Endemism Status	Source
6	Sp: <i>Crocidura suaveolens</i>	Garden Shrew	Open lands and bushy areas	2	nt	nt	A-III	-	-	L
7	Sp: <i>Sorex araneus</i>	Forest Shrew	All kinds of habitat, woody, bushy areas	2	nt	nt	A-III	-	-	L
	Ordo: Lagomorpha	Lagomorpha								
	Fam: Leporidae	Leporidae								
8	Sp: <i>Lepus europaeus</i>	Hare	All kinds of habitat	3	nt	nt	A-III	A-III	-	D
9	Sp: <i>Oryctolagus cuniculus</i>	Rabbit	Sandy, bushy, partly woody lands	2	nt	nt	-	A-I	-	L
	Ordo: Rodentia	Rodentia								
	Subordo: Myomorpha	Myomorpha								
	Fam: Cricetidae	Cricetidae								
10	Sp: <i>Cricetulus migratorius</i>	Grey Hamster	Meadow, fields, steps and distorted forest	1	nt	nt	-	-	-	L
11	Sp: <i>Pitymys subterraneus</i>	Small Fossorial Rodent	Forest, bushy areas and cultural lands	2	nt	nt	-	-	-	L
	Fam: Muridae	Muridae								
12	Sp: <i>Apodemus mystacinus</i>	Rock Rat	In-forest and open rocks	3	nt	nt	-	-	-	L
13	Subsp: <i>Mus musculus musculus</i>	Eastern Rat	Built-up areas and their surrounding, open lands	3	nt	nt	-	-	-	L
14	Sp: <i>Rattus rattus</i>	House Rat	Built-up areas and grassy, bushy, streamsides	2	nt	nt	-	-	-	D

IV.2.13 Fuel sources (from which line the gas will be taken, distance of project area to natural gas pipeline)

The natural gas to be used as fuel in the station will be taken from the Turkey-Greece Natural Gas Pipeline passing through approximately 3 km to the south of the station site and accomplished by BOTAS. As seen in the General Layout Plan given in the Annex 6, by means of a connecting line, maximum 175.000 Sm³ of natural gas per hour shall be transported to a pressure reducing and measuring station located out of the combined cycle station site before the power plant. Since the connecting pipeline and the pressure reducing and measuring station shall be designed and constructed in compliance with the standards of BOTAS in accordance with the agreement to be signed between ENERJISA and BOTAS; there shall not occur any adverse effect during the transportation of the natural gas. In the other Project, the natural gas storage plant is not required.

IV.2.14 Places With High Landscape Values And Recreational Areas

There are no places with high landscape values or recreational areas near the Project Site.

IV.2.15 Lands that are under judging and saving of the authorized organs of the State (Military interdicted areas, lands allocated for public enterprises and organizations with definite purposes, areas limited by the decision of the cabinet numbered 7/16349 etc.)

There are no lands that are under the judging and saving of the authorized organs of the State (military interdicted areas, lands allocated for public enterprises and organizations with definite purposes, areas limited by the decision of the cabinet numbered 7/16349 etc.) at the Project Site and its impact area.

IV.2.16 Specifying the current pollution load of the region (in view of weather, water, soil and noise)

For the purpose of establishing data for the EIA, study, determining and assessing the environmental impacts, a number of environmental studies have been performed to determine the current status of the Project Site and its vicinity..

Within the scope of these studies, air quality, noise measurement studies and sea water sampling studies have been made. The pollution data to be established as a result of these studies has been revealed and the measures to be taken have been detailed under the title of Part V.

Pollutant Gases and their Sources

In Balıkesir, the Provincial Public Health Laboratory has been performing air pollution measurements by means of a semi-automatic device on the basis of SO₂ (Sulphur Dioxide) and PM (Particulate Material) parameters (by Titrimetric method for SO₂, by Reflectometric method for PM) since 1989. In addition to this, the air pollution measurements are performed at 4 stations by means of 8 items of full-automatic devices in total 4 of which measure SO₂ and 4 of which measure PM as 1 item of SO₂ analyzer and 1 item of PM analyzer at each station purchased by the Head of Environmental Protection Foundation of Balıkesir since 1994.

Sulphur Dioxide Concentration and Smoke

The main source of this pollutant seen in winter is the fossil fuels consumed for the purpose of heating and energy generation. Particularly, approximately 90 % of sulphur dioxide (SO₂) comprises as a result of burning fossil fuels. The remaining 10 %, as for, is

originated from the industrial activities and fuels consumed in the vehicles. On the other hand, 20 % of the smoke is originated from fuels.

The main reasons of the air pollution caused by heating can be listed as the usage of poor quality fuels in heating without subjecting them to any enrichment process, the application of incorrect burning methods and not carrying out the maintenance of the used boilers regularly. This poses significant hazard especially in the regions where the heating period is longer.

In addition to these, the rapid population concentration and the unplanned settlement of the cities according to the topographic structure and meteorological conditions take place a key role in the increase of air pollution as well.

The values of sulphur dioxide (SO₂) for the heating periods of 2001-2002, 2002-2003, 2003-2004 October-March in Balıkesir are given in Table IV-46.

Table IV-46. Measurement Results of SO₂ for the Heating Period of 1995-2005 October-March

PERIODS	OCT	NOV	DEC	JAN	FEB	MAR	Average
1999-2000	61	169	203	199	127	66	137
2000-2001	36	105	66	87	65	44	67
2001-2002	18	89	124	155	129	62	96
2002-2003	31	144	182	129	116	81	113
2003-2004	14	78	74	66	63	32	54
2004-2005	11	55	99	70	39	43	53
October-March Limit Value	250	250	250	250	250	250	250

The Impacts of the Air Pollutants on the Environment

The impact of the air pollutants reveals itself on the climate, animals and flora. The researches shows that the air pollution usually rises average heat of the atmosphere, reduces the wind speed, brings about losses in the ultraviolet beams descending into the earth and even changes the normal course of the precipitations due to the reason that the formation of the clouds speeds up upon the increase of the hygroscopic materials as a result of the energy heating the air.

It is obvious that the changes occurring at the climatic balance can cause extremely adverse impacts on the habitat due to the air pollution; on the other hand, these harmful impacts of the air pollution is seen on the animals and flora in various manners and this unsettles the ecological balance as well as it influences either animal production or vegetable production, that's agricultural production adversely.

The indirect impacts of the acid rains are seen on the soil. The acid rains are hazardous for the plants growing on these soils by having impacts on the chemical structure and biological conditions of the soil. The sulphuric acid reaching to the soil increases the soil's acidity, that's the density of the active hydrogen ions. H^+ ions. This ions substitute the nutrition elements such as K^+ , Mg^{++} and Na^+ as Ca^{++} being in the first place held by the clay minerals and humus colloids which are the colloid complexes of the soil and lead them to be flushed as to mix into the ground water from the soil. Flushing away of macro nutrition elements from the soil in this manner leads the loss of fertility and also the washing away of the micro nutrition elements. The acid accumulation in the soil prevents the nutrition elements to be used by the plants. At the same time,, the acid rains ensure that the toxic materials such as iron, aluminium and manganese in the soil come out.

Water Pollution

For the purpose of determining the pollution in the water resources, within the scope of the "Simav Stream Industrial Environmental Pollution Analysis and Study Project" by TUBITAK, the studies have been made for determining the amount and contribution of the key contaminants in the Watershed of Simav Stream which is one of the important rivers of Balıkesir and in the tributaries connecting to Simav Stream. Within the scope of the study, the measurements and analysis have been performed in order to detect the water quality by defining 14 different measuring and sampling points along the flow direction of Simav Stream to the Marmara Sea and at the points connecting to Simav Stream. Simav Stream is under the continual pressure of the intense settlement, industrial activity and the contaminants contained by the surface waters returning from agriculture. For this reason, the characteristics and amount of the contaminants have been tried to be detected by taking into consideration these characteristics in the selection of the sampling points.

Simav Stream establishes a receiving body for the significant amount of industrial and domestic waste waters after entering within the borderies of Balıkesir. Especially for the hot and dry periods when the water flow significantly decreases, the concentration of the contaminant parameters increases. For this reason, the critical contamination conditions occur in these periods. Especially for the dry periods, it his becomes much more significant.

Soil Pollution

In general, the soil pollution can be identified as the loss of the soils' capability to give natural, healthy, high quality and high level products expected from them by deteriorating their natural structures by the physical, chemical and biological factors. In addition to this, the adverse interaction of the soil with the other atmospheres (water and air) in the nature is in question.

The factors leading the soil pollution;

- Industrial Waste
- Urban and Domestic Waste
- Pesticide Utilization
- Incorrect Fertilizing
- Waste Water Usage for Irrigation

There is no general study that has been made on the soil pollution of Balıkesir by the metals and microbiologically. However, some of the facilities discharges their waste water to the city sewerages or to the surface waters and irrigation channels without applying any treatment. These contaminated waters are also used for the irrigation of the agricultural fields. In this case, pollution problems occur both in the soil and in the various agricultural activities.

The incorrect fertilizing practices are the other reason of the soil pollution. Particularly, the soil and water pollution are caused by the unconscious and excessive usage of the fertilizers including Nitrogen (N), Phosphor (P) and Sulphur (S).

Especially, the accumulation of the pesticides has significant side effects on the soil, the soil organisms, the cultivated vegetations and the other plants, the deterioration of the air and water quality and the domestic and wild animals.

A part of the pesticides contains heavy metals and causes heavy metal accumulation in the soil. In this case, the growth of another cultivated plant may be hindered. Consequently, the soil pollution is important due to the reason that the hazardous materials of the soil which originated from very different contaminant resources are consumed by the products grown on the soil or by the animals fed on the meadows and pastures.

Noise Pollution

There exists the noise pollution originated from the industrial enterprises close to the settlements. However, the necessary measures are being taken for the purpose of minimizing the noise occurring by executing the required investigations in the enterprises producing higher noise within the limits specified in accordance with the "Regulation on Environmental Noise Assessment and Management" (RAMEN). Moreover, the necessary processes are fulfilled under the regulation by investigating the musical amusement places.

IV.2.17 Other Characteristics

There is no other consideration to be discussed under this title

IV.3 Characteristics of Socio-Economical Environment

IV.3.1 Economical Characteristics (Primary sectors forming economical structure of the region, their place and importance in regional and state economy, other information)

The economy of Balıkesir shows an increasing trend with its port and developed industrial facilities. In Turkey, 15 % of the chemical fertilizer (BAGFAS-Bandırma Gübre Fabrikalari A.S.), 25 % of the brood for meat, 20 % of the brood for egg, 22 % of the white meat (Banvit, Seker Pilic etc.) and 22 % of the egg are produced in Bandırma. The boron mineral which is one of the most important metals of the world is processed in the Hydrogen Peroxide factory located in the region and bound to the Eti Bor A.S.

Bandırma Port is the second greatest port of the Marmara Sea following İstanbul with its capacity of 3.000.000 tones/year. 15 ships up to 20.000 gross tons can approach, load and upload. In 2001, the industrial products of 240,197,554 American dollars in total were exported from Bandırma Port to 51 different countries. On the other hand, various kinds of industrial products and agricultural products costing 154.891.403 American dollars were imported from 23 countries by foreign vessels. In 2001, the part of the export in the amount of 184.316.000 made from Bandırma Port was performed by Eti Holding A.S having borax acid plants in Bandırma. Eti Holding A.S exports borax pentahydrate, borax and boron metals, colemanite, tincal element from Bandırma Port to 42 countries.

Bandırma has a wind power plant comprising of 20 turbines generating electrical energy of 30 MW and established on the area of approximately in its three villages allocating 600 thousand m² area.. It is planned that it shall reach the power of 620 MW by 2010. The project called as Bandırma Wind Power Plant (BARES II) has become the greatest wind power plant of Turkey when it was accomplished and it continues to operate.

General Industrial Classification

The information on the industrial sectors (manufacturing, mining, food, forestry products, etc.) of Balıkesir is given in the Table I-47.

Table IV-47. Distribution of the Industrial Plants in Balıkesir as per the Sectors.

SECTOR	ITEM
Food Industry	196
Leather and Clothing Industry	90
Forestry Products and Furniture Industry	22
Paper and Paper Product Industry	5
Chemistry and Petroleum Products Industry	16
Metal Industry	49
Metal Goods, Machinery, Agricultural Machinery Industry	74
Other Production Industry	65
TOTAL	518

Distribution of the Industry as per the Districts

Table IV-48 Distribution of the Plants in the Central District and Other Districts

DISTRICT	PLANT NUMBER	PERCENTAGE IN TOTAL
Balıkesir	150	28.90
Ayvalık	29	5.59
Balya	4	0.77
Bandırma	77	14.84
Bigadic	7	1.35
Burhaniye	15	2.89
Dursunbey	11	2.12
Edremit	40	7.71
Erdek	2	0.39
Gönen	117	22.74
Gömeç	7	1.35
Havran	22	4.24
İvrindi	3	0.58
Manyas	4	0.77
Marmara	10	1.93
Savaştepe	2	0.39
Sındırgı	4	0.77

Production Technology and Power Usage as per the Industrial Sectors

Food Industry

Food industry looms large in Balıkesir. In particular, milk processing plants and olive processing plants are the leading of them.

Textile Clothing and Leather Industry

There are plenty of tanners engaging in cotton textile and especially in leather industry in Gonen.

Forestry Products and Furniture Industry

In this sector, enterprises are mostly producing lumber, woodwork, door frame and furniture. The State Forestry Lumber Factory in Dursunbey and the Paper Factory SEKA manufacture significant amount of lumber.

Paper Products Industry

In Balıkesir, Paper products factory SEKA produces newprint as well as lumber.

Chemical Industry

In Bandırma, there exist the factory producing chemical fertilizer BAGFAS established on the coast of the Marmara Sea and the Etibank's factories producing sulphuric acid and boric acid.

Stone and Soil-Based Industry

In this sector, there exist the Cement Factory SET at the city center and also various enterprises manufacturing briquette, brick, tile and marble.

Metal Industry

In the heavy industrial and small industrial regions of the central town, there are many small scale rolling plants and tilers.

Metal Goods Industry

There are enterprises manufacturing kitchen tools, stove, wire and nail.

Machine Industry

In Balıkesir, great developments have been made in manufacturing agricultural machineries. Traylor and threshing machines take important place among these agricultural machineries. Moreover, there are the enterprises manufacturing house tools, transformers and generators. The energy used changes as per the sector groups and electrical energy, coal, fuel oil and LPG are used in general.

IV.3.2 Population (Urban and Rural Populations in the district, population movements, migrations, population growth rates, other information)

In general, Balıkesir Province can be divided into three geographic and economical regions in the respect of the population.

- Coastal Regions
- Bottom Lands
- Mountainous Regions

Prior to 1927, there had been no source of information found about the population of Balıkesir. However, it is shown in the Provincial Register of Hudaverdi Gar that the population of the city was 12.953. After the proclamation of the Republic, the population of the city was found as 481,372 in 1930 whereas it was 749,669 in 1970..The population of the province determined to be 910,282 in 1985 and 973,314 in 1990.

In general, the population growth is conspicuous in the coastal regions such as Bandırma, Erdek, Edremit, Burhaniye and Ayvalık. The easement of access to the districts located on a plain such as the Central Town, Gonen, Manyas, Savastepe, Sındırgı and Susurluk leads to the production of various agriculture products and the intense of cattle-breeding and trade facilities lead population growth.

The existence of the mountainous districts such as Dursunbey, Balya, Bigadic, İvrindi and Kepsut slows down the population growth. According to the census of 1965, 68 % of the people reside in the rural lands and 32 % reside in the urban lands. In the inventories of 1990, it was found that 48 % of the people lived in the city centers and 52 % lived in the rural areas. According to the final census made in 2000, it was determined that 54 % of the people lived in the city centers and 46 % lived in the rural lands.

Population Growth Rate

Table IV-49. Population as per the Province and Districts –Annual Population Growth Rate

Districts	Absolute Scores of 1990 Population Census			Absolute Scores of 2000Population Census			Annual Growth Rate (%)		
	Total	City	Village	Total	City	Village	Total	City	Village
Merkez	246,329	170,589	75,740	287,709	215,436	72,273	15.52	23.33	-4.68
Ayvalik	46,827	25,687	21,140	58,738	31,986	26,752	22.66	21.93	23.54
Balya	21,486	2,248	19,238	18,869	1,916	16,953	-12.98	-15.98	-12.64
Bandirma	103,260	77,444	25,816	120,753	97,419	23,334	15.65	22.94	-10.11
Bigadic	50,345	12,976	37,369	49,957	14,550	35,407	-0.77	11.45	-5.39
Burhaniye	34,634	21,805	12,829	43,199	31,227	11,972	22.09	35.9	-6.91
Dursunbey	52,230	13,025	39,205	47,429	14,654	32,775	-9.64	11.78	-17.91
Edremit	63,430	35,486	27,944	93,351	39,202	54,149	38.63	9.96	66.14
Erdek	26,547	13,246	13,301	32,020	18,626	13,394	18.74	34.08	0.7
Gomec	10,092	3,567	6,525	10,938	4,122	6,861	8.46	14.46	5.02
Gonen	67,599	26,489	40,750	71,804	36,263	35,541	6.03	30.05	-13.67
Havran	25,711	8,878	16,833	26,782	10,122	16,660	4.08	13.11	-1.03
İvrindi	37,181	5,019	32,162	37,891	5,772	32,119	1.89	13.97	-0.13
Kepsut	30,138	5,466	24,672	28,022	5,545	22,477	-7.28	1.43	-9.32
Manyas	29,310	5,648	23,662	25,148	5,455	19,693	-15.31	-3.48	-18.36
Marmara	9,792	2,355	7,437	9,446	2,215	7,231	-3.6	-6.13	-2.81
Savastepe	24,337	10,053	14,284	23,355	10,288	13,067	-4.12	2.31	-8.9
Sindirgi	52,004	9,511	42,493	47,784	10,492	37,292	-8.46	9.81	-13.05
Susurluk	43,022	18,906	24,116	43,107	22,305	20,802	0.2	16.53	-14.78
Toplam	974,274	468,758	505,516	1,076,347	577,595	498,752	9.96	20.87	-1.35

Population Densities of the Province and Districts

In Balıkesir, the population is concentrated in the coastal regions which are Bandirma, Erdek, Edremit, Burhaniye and Ayvalik and in the plains such as the central town, Gonen, Manyas, Savastepe, Sındirgi and Susurluk. The outcomes of the population census of 1990 as per the districts are given in the Table IV-49.

Bandirma is the district having highest population of Balıkesir Province with 120,753 people and Marmara is the district having the lowest population with 9,446 people among 18 districts of the province. In Balıkesir, the district having the highest annual population growth rate is Edremit with the rate of 38.6 ‰ and the town having the lowest annual population growth rate is Manyas with the rate of 15.3 ‰.

The city population growth rate of the center of Balıkesir is 23.3 ‰. When the populations of the districts of Balıkesir are investigated, it can be seen that the town having the highest city population is Bandirma and that the town having the lowest city population is Balya. The town having the highest city population growth rate is Burhaniye

with the rate of 35.9 ‰ and the town having the lowest city population growth rate is Balya with the rate of 16 ‰.

The annual population growth rate of all sub-districts and villages bound to Balıkesir is 1.4 ‰. Population density, which is referred as the number of the people per km², is 75 people throughout the province, 198 people at the city center and between 20 and 222 people as per the districts. Population density of Dursunbey which is ranked as number one according to the surface area, is 24 people; and in Marmara, having the lowest surface area, the population density is 61 people.

643 of the 941 villages of Balıkesir have population less than 500 and a lower population density. The population densities according to the population census of 2000 are given in the Table IV-50.

Table IV-50. Population Density of Balıkesir and Its Districts

Towns	Population	Area (km²)	Population Density
Center	287.709	1.454	198
Ayvalık	58.738	265	222
Balya	18.869	936	222
Bandırma	120.753	592	204
Bigadic	49.957	1.028	49
Burhaniye	43.199	280	154
Dursunbey	47.429	1.948	24
Edremit	93.351	731	128
Erdek	32.020	333	96
Gömeç	10.983	223	49
Gönen	71.804	1.118	64
Havran	26.782	543	49
İvrindi	37.891	761	50
Kepsut	28.022	908	31
Manyas	25.148	593	42
Marmara	9.446	154	61
Savaştepe	23.355	409	57
Sındırgı	47.784	1.378	35
Susurluk	43.107	645	67
Total	1.076.347	14.299	75

Population Growth Rate

For the last 73 years, the population of Turkey increased approximately five times.. For the same period, the population of Balıkesir increased approximately two and a half times and increased up to 1.076.347 in 2000.

For the period of 1927-2000, the population of Balıkesir continually increased. The lowest annual population growth rate occurred with 0.60 ‰ in the period of 1935-1940 and the highest population growth rate occurred with 18.3 ‰ in the period of 1955-1960. The annual population growth rate of Balıkesir in the period of 1990-2000 was 10,1 ‰. According to the population census of 2000, the share of Balıkesir within the country population is less than 2 %.

In Balıkesir, the share of the population living in the city reached 53,7 % in 2000. This rate is less than the country average. In Balıkesir, the city population was higher than the village population until 2000. However at 2000, the village population exceeded city population .

IV.3.3 Social Infrastructural services of the region (Education, health, current endemic diseases in the region, cultural services, access to these services)

Education

In Bandırma, 22.977 students are being educated in 33 primary schools (22 of them are in city center, 11 of them are in districts-villages) and 9 high schools. 21.200 of the students are in the city center. Moreover, 856 students are being educated in the Apprenticeship Training Center and 369 students are being educated in the Public Education Center.

In the education year of 1993-1994, 1183 students continue their higher education in the Faculty of the Economics and Administrative Sciences of Bandırma, in the Bandırma Vocational School bound to the Balıkesir University and in the Bandırma Health Vocational School opened in the education year of 1996-1997.

This development in the education level and the literacy rate reaching 100 % bring the cultural life of Bandırma in vividness.

In Bandırma, there is the opportunity of attending various cultural and art events such as exhibition, panel, conference, concert and show in 2 cinemas and in the other halls throughout the year. On the other hand, the city has highly developed local media parallel to the wealth of the socio-cultural structure. Six daily local newspapers, four local radio stations and one local television channel continue their activities.

Health

The list of the medical establishments and institutions of Bandirma District where Bandirma NGCCS will be located are given below:

- Bandirma Dr.M.Guven Karahan Public Hospital
- Bandirma Kapidag Public Hospital
- Bandirma Public Health Laboratory
- Bandirma Central Health Center No. 1
- Bandirma Central Health Center No. 2
- Bandirma Central Health Center No. 3
- Bandirma Central Health Center No. 4
- Bandirma Central Health Center No. 5
- Bandirma Central Health Center No. 6
- Bandirma Central Health Center No. 7
- Bandirma Central Health Center No. 8
- Bandirma Aksakal Health Center
- Bandirma Cepni Health Center
- Bandirma Buyukyenice Health Center
- Bandirma Gokceyazi Health Center
- Bandirma Kayapa Health Center
- Bandirma Korucu Health Center

Cultural Facilities

Bandirma has become a migration drafting area in general and a cosmopolitan settlement unit in where various cultures come together. In the district,Tatar and Nogay culture migrated from Crimea and the Caucasian cultures are highly observed.

IV.3.4 Urban and Rural Land use at the Project Site and Its vicinity

Within the scope of the Collective Housing Project executed by the Headship of the Presidential Collective Housing Administration in Balikesir Province in 2004, the Collective Housing Projects including the development of 728 houses in the Central Aysebaci District, 766 houses in Stage II Region I and 480 houses in Stage II Region II are at the stage of construction.

Moreover, the Collective Housing Project for 516 houses planned in Kizikkoyu of Manyas District by the Headship of the Presidential Collective Housing Administration is also at the stage of construction.

Population Density of Urban Areas

Population densities of urban areas in Balıkesir Province are given in the Table IV-51.

Table IV-51. Population Density of Urban Areas

District Name	Population	Area	Density
Altieylul	2,741	82,152	33,364
1.Orucgazi	4,108	154,440	26,599
Haciismail	1,244	48,158	25,831
2.Orucgazi	927	36,202	25,606
Vicadniye	2,243	94,138	23,826
Ali Hikmet Pasa	10,581	453,860	23,313
Ege	3,554	162,817	21,828
Yildirim	1,977	95,653	20,668
Karaoglan	1,165	57,712	20,186
Karabey	3,269	162,101	20,160
Cay	1,322	66,787	19,944
Aygoren	1,371	72,824	18,826
Hisarici	1,422	76,279	18,642
Mirzabey	1,739	107,345	16,200
Haciilbey	1,728	107,238	16,113
Karesi	976	61,633	15,835
Kasaplar	5,218	338,486	15,415
1.Gundogan	8,021	550,028	14,582
Eski Kuyumcular	1,946	136,322	14,275
Ataturk	13,928	1,112,080	12,524
2.Gundogan	8,875	941,960	9,421
Kizpinar	1,509	160,848	9,381
Adnan Menderes	10,418	1,112,341	9,365
Dumlupinar	1,414	163,060	8,671
Akincilar	1,404	168,322	8,341
Sutluce	5,532	677,478	8,165
II.Sakarya	10,676	839,018+548,516	7,694
Dinkciler	7,058	938,961	7,516
Bahcelievler	17,699	2,391,536	7,400
Maltepe	7,324	594,082+435,246	7,115
Yildiz	3,861	613,679	6,291
I.Sakarya	8,262	1,368,835	6,035
Hasan Basri Cantay	7,682	1,311,697	5,856
Toygar Ustu	10,377	1,327,024+728,744	5,047
Plevne	5,776	1,212,978	4,761
Gumuscesme	8,161	3,260,470	2,503
Gaziosmanpasa	4,350	1,868,478	2,328
Pasaalani	6,606	7,681,584	859
Kuvay-i Milliye	1,282	266,7831	480
TOTAL	215,829	34,988,943	6,168

IV.3.5 Income and Unemployment (distribution of the income among sectors, maximum, minimum and average incomes per capita among the sectors)

Occupational Sectors and Unemployment

The unemployment rates in the Provincial Center of Balıkesir and in the town centers are nearly the same. The unemployment rate is 10.2 % at the Provincial Center of Balıkesir 10.1 % in the town centers whereas it is 2.1 % in the villages.

The unemployment rate of males is much higher than females in the villages whereas the unemployment rate of females is much higher than males in Balıkesir and in the town centers. The unemployment rate of the province and the villages are 23 % and 1.1 % for females and 7.2 % and 3 % for males; respectively.

Migrations

The average household growth of Balıkesir is decreasing. The average household growth of Balıkesir decreased to 3,5 people in 2000 whereas it was approximately 5 people in 1955.

There was an intense immigration to Balıkesir due to the reason that it has tourism potential and the population growth rate increased correspondingly.

Seasonal Workers

In Balıkesir, there occurs seasonal worker flow to the tourism regions in the summer season and to Balıkesir and Gulf Towns in the olive picking season in autumn.

IV.3.6 Other Characteristics

There is no other issue to be considered in this section.

V. IMPACTS OF THE PROJECT ON THE AREA SPECIFIED IN CHAPTER IV AND THE MITIGATION MEASURES TO BE TAKEN

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

V.1 Activities during the Site Preparation and Construction Phases, Impacts on the Physical and Biological Environment and the Mitigation Measures to be Taken

Activities during land preparation, construction and operation phases, and the measures to be taken are detailed under the following parts.

V.1.1 Location and Amount of Excavation Works During the Site Preparation and Construction Phases (including transportation infrastructure) , Storage Areas for Excavation Materials such as Soil, Stone, Sand etc. and Their Transportation and Utilization, Materials, Equipment and Machinery to be Used during Land Excavation, Dust Generating Mechanical Processes like Crushing, Grinding, Transportation and Storage, The Mitigation Measures to be taken against Dust Emission***Machinery and Equipment to be used during Excavation Works***

At the stage of preparing the land, excavation shall be required for the foundations, water and fuel pipelines of the buildings and units in the project area.

In the District Building Scheme Intended Geological and Geotechnical Survey Report arranged in the area on which the NGCCPP of Bandirma NGCCPP is planned, the ground characteristics of the project area have been explicated and the ground safety tensions have been provided for the construction of the units planned to be built on the site (identified in detail in Part V.1.3.).

At the stage of preparing the land, approximately 400.000 m³ of excavation in total shall be performed in various depths on a closed area of 200.000 m² in total and the excavation material that shall not be used in back loading shall be used for the purpose of leveling within the project site. The calculations for the dust arising from the excavation to be performed in the Project Site are given in the Appendix-17 - Air Quality Modeling Study.

It is accepted that the excavation works shall last 9 months and shall be operated at the day hours over one shift a day.

In average 2 m excavation shall be performed in the construction site. In this case, the excavation amount will be consisted; $200,000 \text{ m}^2 \times 2 \text{ m} = 400,000 \text{ m}^3$.

If it is accepted that the density of the soil is 1.6 ton/m^3 ;
 $400,000 \text{ m}^3 \times 1,6 \text{ ton/m}^3 = 640,000 \text{ tones}$ soil shall be removed.

Because of the distance of excavation soil storing area is maximum 1000 m. from the locations where the operations will be performed, this value was used for the calculations of the dust that might occur.

Emission Factors

Extraction Emission Factor 0.025 kg/t
 Loading-Unloading Emission Factor 0.010 kg/t
 Vehicle Movement (Return) Factor $0.7 \text{ kg/vehicle-km}$

Total Dust Emission to Occur During Removing the Excavation Soil

$$\text{Dust Emission} = \frac{\text{Annual Production Capacity}}{\text{Annual Operation Period} \times \text{Daily Operation Period}} \times \text{Emission Factor}$$

$$\text{Dust Emission} = \frac{640,000 \text{ ton}}{9 \text{ months} \times 26 \text{ days} \times 8 \text{ hours/day}} \times 0.025 \text{ kg/ton}$$

Dust Emission = 8.55 kg/h

Total Dust content to Occur During Loading the Excavation Soil

$$\text{Dust Emission} = \frac{\text{Annual Production Capacity}}{\text{Annual Operation Period} \times \text{Daily Operation Period}} \times \text{Emission Factor}$$

$$\text{Dust Emission} = \frac{640,000 \text{ ton}}{9 \text{ months} \times 26 \text{ days} \times 8 \text{ hours/day}} \times 0.01 \text{ kg/ton}$$

Dust Emission $\approx 3.42 \text{ kg/h}$

Total Dust content Originated During Transporting (Return) the Excavation Soil

$$\text{Occasion Number} = \frac{\frac{\text{Annual Production Capacity}}{\text{Truck Capacity}}}{\frac{\text{Annual Operation Period}}{\text{Daily Operation Period}}} = \frac{\frac{640,000 \text{ ton}}{23 \text{ ton/truck}}}{9 \text{ months} \times 26 \text{ days/month}} \approx 119 \text{ occasion/day}$$

$$\text{Dust Emission} = \frac{\text{Number of Trucks} \times \text{Emission Factor} \times \text{Distance}}{\text{Daily Production Capacity}}$$

$$\text{Dust Emission} = \frac{119 \text{ occasion/day} \times 0.7 \text{ kg dust/truck-km} \times 1 \text{ km} \times 2}{8 \text{ hours/day}} \cong 20.83 \text{ kg/h}$$

Total Dust content to Occur During Unloading the Excavation Soil

$$\text{Dust Emission} = \frac{\text{Annual Production Capacity}}{\text{Annual Operation Period} \times \text{Daily Operation Period}} \times \text{Emission Factor}$$

$$\text{Dust Emission} = \frac{640,000 \text{ ton}}{9 \text{ months} \times 26 \text{ days} \times 8 \text{ hours/day}} \times 0.01 \text{ kg/ton}$$

Dust Emission $\approx$ 3.42 kg/h

Total Dust Emission to be Generated during Excavation

Excavation	: 8.55 kg/hr
Loading	: 3.42 kg/hr
Transportation (loading-unloading)	: 20.83 kg/hr
Unloading	: 3.42 kg/hr

Total Amount of Dust Emission : 36.22 kg/hr

Conclusion

The dust emission calculations were worked out by considering the worst case and by presuming that no measures were taken. In consequence of the calculations worked out, as the dust emission will be occurred inside of the site while the vegetable top soil is being taken is higher than the value of 1.5 kg/hour which is given in the RCAPOIE came into force by issued in the Official Gazette dated 22.07.2006 and numbered 26236 the contribution values to the air pollution were calculated.

The equipments to be used for the preparation of the land and construction of the units are given in the Table V-1.

Table V-1. List of the Machinery and Equipment to be Used for the Preparation of the Land and Construction Works

MACHINERY-EQUIPMENT NAME	CAPACITY	ITEM
Crawler Crane	900 t	1
Mobile Crane	300 t	1
Mobile Crane	140 t	1
Mobile Crane	80 t	2
Mobile Crane	60 t	3
Mobile Crane	45/50 t	2
Mobile Crane	30 t	1
Derrick Crane	12 t	2
Trailer Car	80 t	1
Trailer Car	50 t	1
Trailer Car	20 t	2
Truck	20 m ³	7
Tractor	-	4
Diesel-generator	500 kVa	2
Diesel-generator	250 kVa	4
Diesel-generator	150 kVa	2
Diesel-generator	100 kVa	4
Diesel-generator	50 kVa	14
Compressor	350 cfm	1
Compressor	250 cfm	1
Excavator	-	2
Wheel Loader	-	2
Crawler Loader	-	1
Compactor	-	1
Water Tank	20 t	3
Transit mixer	6 m ³	4
Autobus (for 50 people)	-	2
Midibus (for 20 people)	-	2
Minibus (for 9 people)	-	2
Pick-Up	-	4
Pick-Up	-	8
Car	-	15
Ambulance	-	1
Firebrigade Truck	-	1

If there is no emission restriction in the Annex 5 for a plant subjected to the permission included in the Annex 1 and Annex 8, List A and B of the Regulation, it is mandatory to comply with the emission restrictions given in the Annex 1 and with the provisions specified in the Annex 5. In accordance with the paragraph 8 of the subclause 'a' of the Annex 5 of the Regulation, the provisions specified shall be complied with in the Plant.

At the stage of the preparation of the land, the excavation material shall be taken from the site by means of the dipper and loaded into the trucks. For the purpose of preventing the dust occurring at the stage of taking and transporting the excavations, the material shall be loaded without scattering and transported by being covered with a nylon tarpaulin in accordance with the RCAPOIE coming into the force by being issued on the Official Gazette dated 25 June, 2006 and numbered 26236.

V.1.2 Transport, Storage and Usage of Flammable, Explosive, Hazardous, Toxic and Chemical Materials to be used during the Site Preparation and Construction Phases, Equipment and Machinery to be used for These Works

For excavation works to be performed during preparation of the land, any explosive or toxic substance shall not be used. The land, by means of diggers, shall be met the desired conditions. Therefore, it is out of the question to use of any machine-equipments in the Power Plant area for that purpose.

The paints and solvents to be used in the stage of the construction of Bandirma NGCCPP are inflammable materials. In transporting, storing and using of these substances, it shall be observed the provisions of "Guidelines on Measures to be Taken in the Work Places and Works Being Worked with Inflammable, Explosive, Hazardous and Harmful Substances" came into force by issued in the Official Gazette dated 24 December 1973 No. 14752.

V.1.3 Activities to be Carried out for Ground Safety (Bearing Capacity, Allowable Stress, Settlement Calculations)

Whether the project area ground characteristics are scrutinized in the District Building Scheme Intended Geological and Geotechnical Survey Report of Bandirma NGCCPP, the allowable bearing values are given to build of the units planned the construction on the site (see. App. 10).

Any site which is not appropriate to construct the buildings does not exist in consequence of morphological, geological and geotechnical studies. It is observed that the project area completely consisted of gravel clayed arenaceous concerning neogene sequence. By reason of the fact that there is no any problem such as settlement problem, expansion, liquefaction, inadequacy in bearing capacity of the investigation area is included to class appropriate area (UA) for localization in accordance with the consequences of laboratory and the consequences of SPT on the ground prevailed by neogene sediments. As a result of Geological-Geotechnical Studies which are given in App.-10, any negative aspect is determined in terms of the ground.

V.1.4 Location and Methods of Flood Prevention and Drainage Works

The nearest creek to the project area is the Hotaci Creek in the east of 750 m. On account of the flow direction of the respective creek is north-south directional, there is no any flood risk that would affect the Power Plant site concerned.

Through the ground water levels are rather low in the project area and those have the permeability by reason of the structure of the rocks, liquefaction on the ground is not expected. However, the studies shall be performed in accordance with the relevant regulations in the project to be achieved.

The natural disaster occasions such as landslide formed creep and yielding, rock fall, avalanche, overflowing associated with fall, flood, ponding and ground water overflow were not encountered in the project area and its immediate surroundings.

In concern with the structures to be built on the project area, the provisions of "Regulation on the Structures to be Build on the Disaster Areas" which was issued in the Official Gazette dated 2 September 1997 No. 23098 shall be punctiliously observed.

V.1.5 System and Plan for Water Supply, Amount of Water that Will be Used, Reservoirs and Methods for Water Supply, Characteristics and Amount of Wastewater, Method of Treatment and Receiving Bodies

Water amount to be used by the personnel at the stage of construction;

The waste water to arise from the various usages of the personnel of 700 people to be employed at the stage of construction of the Power Plant shall fully comprise of the domestic waste waters. The domestic waste water amount to be caused by the personnel can be calculated as follows when considering that 100 L/day per capita is consumed and that all water consumption shall convert into waste water which is the worst possibility:

$$700 \text{ people} \times 100 \text{ L / person-day} = 70\,000 \text{ L/day} = 70 \text{ m}^3/\text{day}$$

There shall be the need for water in the amount of approximately 70 m³/day to be used in the construction activities within the scope of the Project. This need for utility water to be used in the construction activities shall be supplied by purchasing from the market by means of tankers.

Water amount to be used at the stage of Operation

The water amount to be used at the stage of operation has been discussed under two different titles as the water amount necessary for the use by the personnel and the water amount to be used in the process as follows.

Water Amount to be used by the Personnel

It is planned that 100 people shall be employed at the stage of operation within the scope of the activity.

$$\text{It is found as } 100 \text{ people} \times 100 \text{ L/person-day} = 10.000 \text{ L/day} = 10 \text{ m}^3/\text{day}.$$

During 12 months at the stage of operation in the activity area, the personnel shall work for 30 days. Accordingly, the total water consumption;

$$\text{Total Water Consumption} = \text{Daily Water Consumption} \times \text{Operation Period}$$

$$\text{Total Water Consumption} = 10.000 \text{ L/day} \times 12 \text{ month/yr} \times 30 \text{ day/month} = 3.600 \text{ m}^3/\text{yr}.$$

The water to be used by the personnel (at the stage of operation) shall be supplied by means of desalination.

Water Amount to be used at the Stage of Construction;

There shall be the need for water in the amount of approximately 40 m³/day to be used in the construction activities within the scope of the Project. This need for utility water to be used in the construction activities shall be supplied by purchasing from the market by means of tankers.

Water Amount to be used at the stage of Operation

Water Amount to be used in the Process;

For Bandirma NGCCPP, The demands for the boiler feeding water, the cooling water and the service water for some domestic and industrial purposes in the Power Plant shall be met with the raw water to be provided from the Marmara Sea. For the purpose of the preparation of the boiler feeding water, some portion of the sea water shall be sent to Desalination and Demineralization units. The major portion of the desalinated water removed from the desalination unit shall be sent to the demineralization unit. The demineralized water, to be stored in the demineralized water tank shall be used primarily as the boiler feeding water and for certain purposes such as chemical solution preparation and chemical cleaning. The remaining part of the desalinated water shall be stored in the raw water tank and it shall meet the service water need of the Power Plant when necessary. The sea water to be used as the cooling water shall be given to the sea again from the single-pass cooling cycle without being subjected to any chemical process. The details of the desalination and demineralization systems are given in the following.

Desalination Unit

The desalination unit is a treatment unit ensuring that the sea water is desalinated for the purpose of usage in the process.

In the desalination system, in order to make the sea water compatible for being passed through the membrane cycles operating with the adverse osmosis mechanism, a number of pre-treatment processes exist. The pre-treatment process starts with the sieves at the fore part of the water intake structure to be built in the sea. The purpose of these sieves is both not to deteriorate the ecology of the sea and not to cause biological blockings in the system by preventing the sea organisms from entering into the system while the water is taken from the sea. Moreover, a control system holder and alerter for the layers arising from all oil and hydrocarbon leakages that might exist on the sea surface shall be a part of the preliminary treatment process.

The sea water passed through fine sieves shall be subjected to the disinfection by means of the chlorination system subsequently. The sea water disinfected and separated from its grain particles is desalinated by being passed through the adverse osmosis membrane cycle. There are two different water flows at the output of the adverse osmosis unit. First is the desalinated sea water and the second is the waste water having dense salinity called as concentrated salt solution. This waste water shall be given to the discharged of return cooling water. In the waste water coming out of the membrane cycles, the quantities of the residual chlorine and the other conditioning chemical residuals shall be continually monitored and their conformity with the values given in Water Pollution Control Regulation (WPCR) shall be ensured.

The water amount to be taken from the sea for the purpose of desalination in order to meet the needs of the Power Plant is 90 m³/hr. At the end of the desalination process, the waste water shall occur as the concentrated saline water of 65 m³/hr. The 22 m³/hr of the desalinated water to be supplied as product from the desalination unit shall be stored in the demineralization unit and 3 m³/hr of it shall be stored in the water storing tank in order to be used as the service water.

Demineralization Unit

In Bandirma NGCCPP, there shall exist the need for demineralized water such as boiler feeding, potable and utility, chemical cleaning and solution preparation. As raw water in the demineralization unit, the water produced in the desalination unit shall be used. For this purpose, 22 m³/hr of water shall enter into the demineralization plant.

By removing the impurities and minerals within the desalinated sea water, demineralized water compatible for being used in the process shall be prepared. The current desalted water subjected to the preliminary treating and preliminary disinfection shall be made pass through adverse osmosis membrane and complex ion exchange bed. In the demineralization unit, there shall exist air blowers, feeding pumps, heaters, ion exchange columns, HCl tank and pumps, NaOH tank and pumps, neutralization pond and pumps and the necessary measuring-control devices. HCl and NaOH systems shall be located in different rooms and the drainage of the catch basin under the tanks shall be connected to the neutralization pool. Neutralization shall be performed according to the pH-meter measuring and held between pH 6 and 9. In the demineralization unit, backwash and regeneration originated waste water shall occur. These waters shall be made compatible with discharge by being combined with the relief and gathering channels to be built for the Water Treatment Plant. The waste water, as for, requiring treatment beyond the neutralization shall be treated by the treatment method compatible with the waste characteristic by being sent to the Power Plant waste water treatment plant.

The backwash and regeneration waste waters to be originated from the active carbon cleaning water and regeneration plants by water softening, demineralization and

regeneration shall be given into the general drainage system of the Power Plant after made compatible with the criteria given in the Table 20.7 WPCR.

Service Water

The demand for the service water to be used at the Power Plant shall be met from preliminary treated water storage tank. The service water used shall be connected to the cooling water discharge system by means of the system in which the rain waters and the surface waters are gathered by passing from the oil separator through the general drainage system. The water mass balance diagram of Bandirma NGCCPP is given in the following table.

Domestic Wastewater Treatment Plant

At the construction stage of the Power Plant, the package type of treatment plant shall be utilized. At the operation stage, as for, a domestic wastewater treatment unit having the capacity of 10 m³/day shall be used as to provide service for the population of 100 people. In the domestic wastewater treatment plant, there shall be used the method of air conditioned biological treatment. Within this process, there shall be present the physical treatment, co-precipitation and air conditioning systems. The air conditioning system shall be used for the recyclable active clay system to fractionate the organic contaminants of the microorganisms by supplying the sufficient oxygen.

The discharge shall be made from the domestic wastewater treatment plant shall be treated in compliance with the criteria given in the WPCR Table 21.1. The treated domestic wastewater shall be discharged into the sea by being combined with the cooling water discharge made compliant with the criteria specified in the WPCR Table 9.6.

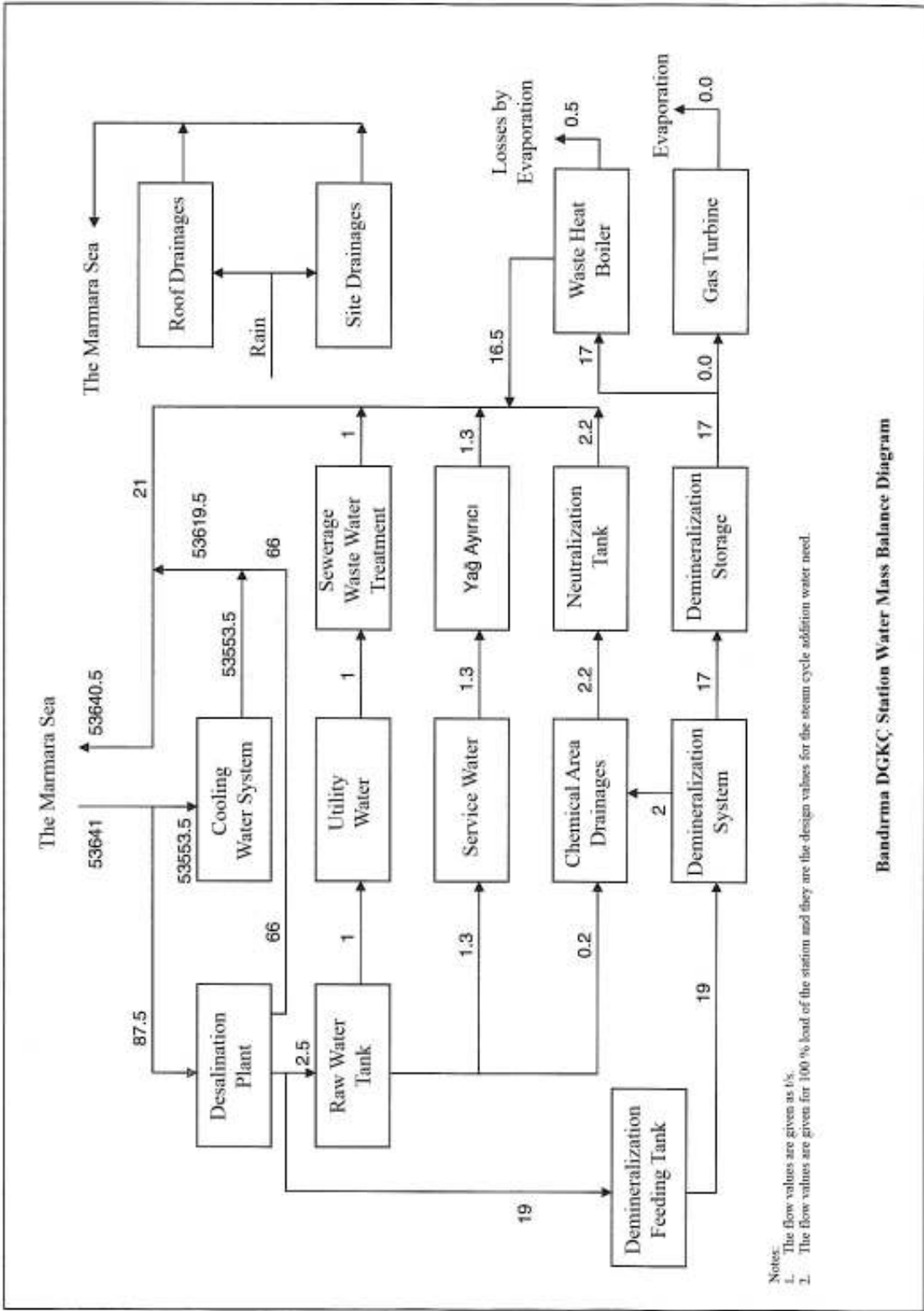


Figure V-1. Water Mass Balance Diagram of Bandırma NGCCPP

Treatment Plant Design Criteria (Construction Phase)

Characteristics of Wastewater

The following values were taken during the design of the Wastewater Treatment Plant;

Equivalent Population of the Plant	: 700 persons (max. value)
Water Usage per capita	: 200 L/person – day
Waste water flow rate (approximate):	70 m ³ / day
BOI ₅ Load	: 60 g / person – day
Total BOI ₅ Load	: 60 kg / person – day

According to these data, an “Aboveground Type Package Waste Water Treatment Plant” with a capacity that can treat 70 m³/day domestic waste water shall be constructed (see App. 18).

Treatment Plant Outlet Water Quality

Treated water maximum discharge parameter limits permitted to exist in order to comply with the WPCR Table 21.1 Receiving Environment Discharge Standards are as follows:

Table V-2. Contaminant concentration values

PARAMETERS	UNIT	COMPOSITE SAMPLE (2 hours)	COMPOSITE SAMPLE (24 hours)
BOD ₅ *	mg/L	50	45
COD**	mg/L	160	110
SS***	mg/L	60	30
pH****		6-9	6-9

* Oxygen requirement of the water including organic agents

** Oxygen requirement of the organic agents that can be chemically oxidized

*** Floatable solid agents including water organisms and inorganic contamination

**** Water acidity value

Treatment Facility Outlet Water shall comply with Receiving Environment Discharge Standards given in the Table of 21.1 of WPCR.

Treatment Plant Properties

Treatment plant is comprised of the following parts:

1. Pre-Balancing System
 - a. Pre-Sedimentation Tank
 - b. Balancing and System Feeding Pump
2. Package Unit System
 - a. Package Units
 - b. Machinery Sections

Pre-Sedimentation Tank

Here is the first entry gate of the treatment plant. The solid agents entering the facility with the waste water and that cannot be biologically treated and the sediments are collected at the bottom of the chamber, the floating parts at the surface of the chamber is collected. If there are biologically dissolving agent within the sediment and floating agents, as they decay by the time and mix with water, they do not lead any excess accumulation at the bottom or surface of the chamber. The solid agents that cannot be treated biologically and accumulated are removed from the tank by vacuum truck once in a year.

Waste water without any solid agents is taken to the force main from the half level of the tank. By means of this tank, the damage to the equipments from solid particles such as pumps working in the treatment plant, diffuser line within the system is prevented.

The equipments such as strainer and coarse grid mounted at the water inlet part of the pre-treatment facility located at the pre-sedimentation tank are not needed to be used.

Balancing and Feed Pump System

This is the unit where the waste water that cannot enter the treatment facility due to elevation difference is collected. The waste water passing through the pre-sedimentation chamber is collected in this unit and homogenous waste water mixture is ensured. Furthermore, it is a chamber that balances excess waste water inlet by peak flows. The a submersible pump (feed pump) sewage type assembly shall be mounted in the balancing chamber to transfer the waste water accumulated in the balancing chamber to package unit.

Package Units

It is the section where domestic and industrial type waste water are treated biologically. Ventilation, sedimentation, disinfection processes are done subsequently in the package unit (biological reactor). The organic agents, CO₂, H₂O, other metabolic products in the waste water entering this section shall be converted into new active sludge micro organisms by active sludge mass in the ventilation section. The oxygen needed by the system is provided by the air blower through the distribution pipes at the bottom of the chamber.

During sedimentation phase, the activated sludge shall be sedimented to the bottom of the unit by being separated from the biologically cleaned and treated water. The treated water at the surface shall be taken by submersible pump and chlorinated and transferred to the clean water storage. These procedures are controlled and repeated automatically by means of a control panel. In this system, the sludge is mineralized due to the long sludge age. Thus, the sludge can be taken from the system without considering a sludge removal system.

Package Treatment Unit, in order to prevent blockage on the diffuser line providing oxygen to the system, has a by-pass system which is not available in other units. By means of this system, diffuser blockages can be removed easily and rapidly.

Machinery Sections

These are the sections where the equipments, package units (air blower, chlorine dosage pump, discharge pump, control pump etc) are accommodated at the treatment facility.

Wastewater	Discharge	Measurement	Remarks
Continuous			
Cooling Water	Marmara Sea	T,m	From condenser and cooling water system
Neutralization Tank	Marmara Sea	Ph,T,m	Heat Recovery Steam Generator
Interrupted			
Neutralization Tank	Marmara Sea	Ph,T,m	
GT Tank	Truck Transportation		
Fire Extinguishing System	Marmara Sea		
Domestic Waste Water	Septic Tank		
Surface Drainage	Marmara Sea		
Neutralization Tank	Marmara Sea	Ph,T,m	
GT Tank	Truck Transportation		

The cooling water shall not have any bacteriological contamination due to chlorination. Residue chlorine level shall be less than 0.5 ppm. The chemicals that have self-decomposable in the nature shall be used if required in the usage of corrosion and anti scalant. It shall not differ from the crude sea water taken from the water intake structure in terms of physical and chemical properties. As cooling tower is not used, no chemical additives such as zinc, nickel or borate is to be required. Furthermore, as there is no cooling tower, there is no evaporation loss, water driblet emission and hot air discharge.

There shall be no bacteriological contamination in the neutralization tank waste water. According to the corrosion and lime inhibitor type to be used in the Heat Recovery Steam Generator, the water to be discharge from Heat Recovery Steam Generator shall be neutralized. In order not to create any alg explosion or eutrofication due to excess nutrients in sea environment, the phosphate amount to be used as boiler feeding water shall be balanced in the neutralization tank and discharge criteria shall be ensured. The acidity and alkalinity originating from the regeneration water of the ion changing beds and recycled wash water of the mechanical sand and active carbon filters shall also be balanced in the neutralization tank. According to the parameters observed in the control system of the Water Treatment Building, waste water requiring advance treatment shall be transferred to the treatment system to be constructed and be acceptable for discharge.

Chemical Cleaning

The waste water originating from the chemical cleaning to be made prior to the commissioning of the systems, chemical cleaning of any equipment, wet conservation operations are considered within the scope of special waste water. The waste water to originate from such type of processes shall be collected and treated properly or the waste materials shall be transported to the licensed facilities by trucks where such type of wastes can be disposed.

The discharge channels shall be made to collect rain and surface water within the plant area. The surface waters within the plant shall be discharged upon treating the oil by process at the oil scraper traps. It is not possible for such type of water to include any hazardous contaminant other than suspended solids (SS), oil and grease.

V.1.6 Possible Impacts of Activities in Marine Environment on Flora and Fauna, and Measures to be Taken

Two negative impacts over the living system within the Project shall be in question. One of these shall be with the intake of the living things with the cooling water unless an efficient filtration could not be made during the intake of water for cooling purposes. For this purpose, the pipes to be used during water intake from the sea shall have their intrinsic pump and filtration system. These filters shall have rather small pore diameter and their effective operation shall be ensured as much as possible. However, this shall not prevent the harm on the bacteria, nano and micro plankton populations.

However, when the current biological diversity of the region is considered, it is seen that they are formed by species that are endemic or non-extinct species and have wide-spread dispersion. While it is not possible to state that there will be no loss at the end, considering the long term development of this country, this loss can be negligible by using the technologies that can minimize this loss.

The second possible negative impact is the thermal contamination. Water temperature at each zone is specified by the restrictive factors such as absorbed light amount, wavelength of the light, euphoric period and thus the difference arises. The temperature difference at each depth ensures the formation of different biological activity and diversity. The change of temperature at each zone due to any reason shall lead to changes on the life forms in the region. The discharge of the heated water upon usage for cooling to the receiving environment that is an acoustic system and thermal contamination known as the increase of affiliated generation is the most important and may be the only negative impact over the living life. However, the temperature of the cooling water used within activity and heated sea water shall be accorded with the inlet zone temperature and thus a change shall be prevented in such receiving environment.

Apart from these, the occurrence of turbidity, noise and similar effects during the installation of the system may lead the departure of the livings for short periods. The effects arising from turbidity occur also within the natural seasonal cycles. Though the micro organisms will have respiration difficulties due to turbidity, this case shall not affect its populations and be at negligible levels. The species moving away from the activity area will accommodate to the areas with similar ecological conditions nearby. However, whole of the available species are species that have wide spread dispersion area. Thus, they will re-settle upon the removal of such negative effect.

The Water Modeling Study where the thermal discharge dispersion and first dilution calculations are made is given in the App. 27. According to this modeling study results, the necessary distance required for dropping the discharged cooling water temperature difference of 0.3 °C is 1000 m.

Plankton Analysis is given in the App. 19.

V.1.7 Type and Amount of Solid Wastes that will be Generated During Site Preparation and Construction Phases, Transportation and Utilization of these Wastes (Detailed Information on the Characteristics and Lifetime of the Wastes, Attachment of the Permits Obtained as Stipulated by the EIA Regulation)

The solid wastes to arise from the Works up to commissioning of the units starting from the ground preparation of the planned plant and construction phase, domestic solid wastes to arise from the employees, solid wastes to arise from the construction materials, waste oils to arise from the working vehicles and sludge from the treatment plant can be classified as wastes.

If it is assumed that in the construction of the plant 700 persons, and in the operation phase of the plant 100 persons will work and the generation amount of domestic solid waste per capita is taken as 1.34 kg/man – day, then the construction and operation phase domestic solid waste generation amount is calculated as follows by using the following formula:

Domestic Waste Generation Amount per capita : 1, 34 kg/man - day²

Daily Solid Waste Generation = number of working man X domestic waste generation amount per capita

² Turkish Statistical Institution(TURKSTAT) , Environmental Statistics, Domestic Solid Waste Composition Survey and Trend Questionnaire Results, 2004

Construction Phase

Domestic Waste Generation Amount = 700 men X 1.34 kg / man - day

Solid Waste Generation Amount = 938 kg / day

Operation Phase

Domestic Waste Generation Amount = 100 men X 1.34 kg / man - day

Solid Waste Generation Amount = 134 kg / day

The domestic solid waste shall be disposed according to the “Regulation on Solid Waste Control” effective upon publishing in the Official Gazette dated 14.03.1991 and numbered 20814 and the hazardous materials that cannot be reused and recycled and the non-contaminated wastes (such as paper, glass, plastic, metal boxes, cement bags etc) shall be disposed according to the “Regulation on Control of Packaging Materials” effective upon publishing in the Official Gazette dated 24.06.2007 and 26562.

Process Generated Solid Wastes

The process based solid wastes within the project shall be disposed in the framework of relevant regulations.

During the maintenance and fuel supply of the vehicles and machinery used for the ground preparation works, the “Regulation on Waste Oil Control” provisions effective upon publishing in the Official Gazette dated 21.01.2004 and numbered 25353.

The sludge amount to arise from the domestic waste water treatment plant is at negligible amounts and be collected periodically. The treated sludges shall be analyzed and disposed according to the “Hazardous Wastes Control Regulation” effective upon publishing in the Official Gazette dated 14.03.2005 and numbered 25755.

V.1.8 Sources and Levels of Noise and Vibration to be Generated by Project Activities from the Land Preparation to the Operation Phase

The Acoustic Report including the performance of the assessment related to the environmental noise dependent upon the noise sources for the businesses within the The RAMEN App. VII List A and B categories and the technical measures to be taken based upon the calculation to be made according to the specific standards are given in the App. 20.

V.1.9 Types, Amounts and Emission Levels of Fuels to be Used during Project Activities from the Land Preparation to the Operation Phase

Emissions from Fuels

Fuel consumption for the purposes of heating during NGCCPP Project ground preparation and the construction stage shall not be in question. However, the fuel consumption necessary for the heavy construction vehicles to operate during the construction shall be in question. The fuel required for the heavy construction vehicles shall be supplied from the gas stations with licensed Non-Hygienic Establishments (NHE). There shall be a 8-10 ton fuel storage tanks at the site. The emission formation shall be in question as a result of the operation of the heavy construction vehicles at the Project site. The fuel consumption amount of these vehicles is expected as 20 liters per hour.

Table V-3. Diesel Oil Properties

Properties	Diesel Oil
Viscosity	Very fluent
Type	Distilled
Color	Amber
Density (15 ⁰ C) gr/cm ³	0.8654
Viscosity (38 ⁰ C)	2.68
Liquefy Point (⁰ C)	-18
Atomization Temperature (⁰ C)	Atmospheric
Pumping Temperature (⁰ C)	Atmospheric
Carbon Residues (T)	Trace amount
Sulphur (%)	0.4-0.7
Oxygen – Nitrogen (%)	0.2
Hydrogen (%)	12.7
Carbon (%)	86.4
Water and sedimentation (%)	Trace amount
Ash (%)	Trace amount
Heat Value (kcal/l)	9.387

Source: Air Pollution Control and Inspection, Chamber of Chemical Engineers, May 1991

The properties of the diesel oil to be used as fuel in the vehicles during ground preparation and construction works are given in the Table V-3.

The diesel oil required for heavy construction vehicles during the construction phase is estimated to be 20 liter per hour. According to this;

$$Q = 20 \text{ L/h} * 0.8654 \text{ kg/L} = 17.308 \text{ kg/h} (0.0173 \text{ t/h})$$

Table V-4. The Main Emission Factors of the Contamination arising from the Diesel Vehicles (kg/L)

Contaminant	Diesel
Carbonmonoxide	9.7
Hydrocarbons	29
Nitrogen oxides	36
Sulphur oxides	6.5
Dust	18

Source: The Principles for Air Pollution and its Control, 1991

The estimate values of the expected contaminants to arise from the heavy construction vehicles are as follow;

1. Carbonmonoxide: $9.7 \text{ kg/t} * 0.0173 \text{ t/h} = 0.167 \text{ kg/h}$
2. Hydrocarbons: $29 \text{ kg/t} * 0.0173 \text{ t/h} = 0.50 \text{ kg/h}$
3. Nitrogen oxides: $36 \text{ kg/t} * 0.0173 \text{ t/h} = 0.623 \text{ kg/h}$
4. Sulphur oxides: $6.5 \text{ kg/t} * 0.0173 \text{ t/h} = 0.112 \text{ kg/h}$
5. Dust: $18 \text{ kg/t} * 0.0173 \text{ t/h} = 0.311 \text{ kg/h}$

As the mass flow rate values calculated for heavy construction vehicles are small and due to the 2-3 hour maximum operation per day of these vehicles, it is not expected that the emissions will have negative impact on the air quality.

During the fuel usage and disposal of waste oil of the vehicles and machinery used for the ground preparation works, the "Regulation on Waste Oil Control" provisions effective upon publishing in the Official Gazette dated 21.01.2004 and 25353 shall be complied with.

V.1.10 Species and Number of Trees to be Cut for Site Preparation, Natural Plant Species to be Removed and the Land Requirement

There is no tree cutting in question in the Project area due to characteristic of arable field. The only impact for the plant types that is the biomass loss shall be limited due to the scraping of the vegetable soil layer. Upon the completion of the ground preparation and construction phase, these types shall form the previous layer by means of vegetative bodies such as the seed, bulbs, rhizome etc. available in this vegetable soil.

V.1.11 Dust Generating Processes such as Crushing, Grinding, Transport and Storage During Construction and Their Cumulative Values

During the construction activities to be made at the plant, only dust emission shall be in question during excavation. It is presumed that an approximate area of 200.000 m² shall be subjected to excavation works for the foundation bores and land arrangements. It is accepted that the excavation works shall last for 9 months and the works shall be done in one shift at day time hours. Air Quality Modeling Works prepared related to the said Project is given in the App. 17.

It is accepted that the excavation works shall last for 9 months and the works shall be done in one shift at day time hours.

2 m excavation averagely shall be done at the construction site. The amount of excavation in this case;

$$200,000 \text{ m}^2 \times 2 \text{ m} = 400,000 \text{ m}^3.$$

If the density of the soil is accepted as 1.6 ton/m^3

$$400,000 \text{ m}^3 \times 1.6 \text{ ton/m}^3 = 640,000 \text{ ton soil will be excavated.}$$

Due to the distance of the excavated soil storage area is to be maximum 1000 m away from the working area, then this value is used in the dust calculation.

Emission Factors

Removal Emission Factor..... 0.025 kg/ton

Loading – Unloading Emission Factor 0.010 kg/ton

Vehicle Traffic Factor 0.7 kg/vehicle-km

The Dust Amount to arise during the Soil Excavation Works

$$\text{Dust Emission} = \frac{\text{Annual Production Capacity}}{\text{Annual Operation Period} \times \text{Daily Operation Period}} \times \text{Emission Factor}$$

$$\text{Dust Emission} = \frac{640,000 \text{ ton}}{9 \text{ months} \times 26 \text{ days} \times 8 \text{ hours/day}} \times 0.025 \text{ kg/ton}$$

$$\text{Dust Emission} = 8.55 \text{ kg/h}$$

The Dust Amount to arise during the Loading of Soil Excavation Works

$$\text{Dust Emission} = \frac{\text{Annual Production Capacity}}{\text{Annual Operation Period} \times \text{Daily Operation Period}} \times \text{Emission Factor}$$

$$\text{Dust Emission} = \frac{640,000 \text{ ton}}{9 \text{ months} \times 26 \text{ days} \times 8 \text{ hours/day}} \times 0.01 \text{ kg/ton}$$

$$\text{Dust Emission} \approx 3.42 \text{ kg/h}$$

The Dust Amount to arise during the Transportation of Soil Excavation Works

$$\text{Occasion Number} = \frac{\frac{\text{Annual Production Capacity}}{\text{Annual Operation Period}}}{\text{Truck Capacity}} = \frac{\frac{640,000 \text{ ton}}{9 \text{ months} \times 26 \text{ days/month}}}{23 \text{ ton/truck}} \cong 119 \text{ occasion/day}$$

$$\text{Dust Emission} = \frac{\text{Number of Trucks} \times \text{Emission Factor} \times \text{Distance}}{\text{Daily Production Capacity}}$$

$$\text{Dust Emission} = \frac{119 \text{ occasion/day} \times 0.7 \text{ kg dust/truck-km} \times 1 \text{ km} \times 2}{8 \text{ hours/day}} \cong 20.83 \text{ kg/h}$$

The Dust Amount to arise during Unloading of the Soil Excavation Works

$$\text{Dust Emission} = \frac{\text{Annual Production Capacity}}{\text{Annual Operation Period} \times \text{Daily Operation Period}} \times \text{Emission Factor}$$

$$\text{Dust Emission} = \frac{640,000 \text{ ton}}{9 \text{ months} \times 26 \text{ days} \times 8 \text{ hours/day}} \times 0.01 \text{ kg/ton}$$

$$\text{Dust Emission} \approx 3.42 \text{ kg/h}$$

The Dust Amount to arise during the Excavation

Removal	: 8.55 kg/hour
Loading	: 3.42 kg/hour
Transportation	: 20.83 kg/hour
Unloading	: 3.42 kg/hour
Total	: 36.22 kg/hour

Result:

The dust emission calculations are made by considering the worst conditions and no measures taken. As a result of the calculations, as the dust emission to arise within the area during the removal of the vegetable soil layer, is higher than 1,5 kg given in the RCAPOIE effective upon publishing in the Official Gazette dated 22.07.2006 and numbered 26236, the values contributing to the air pollution are calculated.

The proper waste management, handling and disposal of the construction waste and debris to arise from the excavation, construction, repair and restoration of the facility shall be done according to the provisions of the Excavation Soil, Construction and Debris

Waste Control Regulation published in the Official Gazette dated 18.03.2004 and nr 25406.

V.1.12 The Sources for the Supply of Project Personnel and Their Accommodation and Other Technical/Social Infrastructural Needs

The workers shall be employed mainly from the region of the Project Site, pre-training shall be provided and possibility to work at the Plant shall be granted.

Pre-fabricated construction site buildings shall be installed for the purposes of accommodation at the plant area for the personnel to work for the phase from the ground preparation phase to the commissioning of the operational units. All types of units (washbasins, showers, mess hall, canteen, dressing room etc.) to be needed by the workers at the construction site to be established within the Plant shall be available.

Pursuant to the article 180 of "Public General Hygiene Law" all owners employing at least 50 workers continuously are obliged to provide treatment for the workers' health and a doctor to perform regular check-ups. A doctor shall be available at all times at the site or perimeter of the large scale and accident-possible works. The business places outside the cities or towns without hospitals have to provide a patient's room and first aid tools. The businesses having permanent employment from 100 to 500 persons are required to open a hospital, 1 bed per 100 persons.

In accordance with the provision of the General Public Hygiene Law mentioned above, there shall be an infirmary at the Power Plant during operation phase and a doctor shall be assigned. Before starting to the construction works within the Project, the health personnel shall be supplied. Thus, medical waste formation from the infirmary shall be generated during the operation phase and these wastes shall be collected separately from domestic solid wastes in the extent of the Medical Wastes Control Regulation and be delivered to Municipality of Bandırma for disposal area.

The provisions of the Medical Wastes Control Regulation effective upon publishing in the Official Gazette dated 22.07.2005 and numbered 25883 shall be complied.

V.1.13 Determination of Magnitude and Dispersion Extent of the Impacts on Cultural and Natural Assets (Traditional Urban Texture, Archaeological Remains, Natural Assets to be Protected) in the Project Site and Its Vicinity

There is no cultural objects at the Project Site. Thus, no negative impact on the cultural heritage is expected. The cultural and natural heritage in Balıkesir are detailed under the Section IV.2.10.

V.1.14 Project Activities That May Pose Risks and Hazards for Human Health and The Environment

It is possible to highlight these risks as work accidents to occur at all construction facilities, the impacts over the human health, potential health problems during the ground preparation and construction phase. The measures shall be taken to keep work accident risk factor at the lowest level, to minimize the work accidents and all security rules recognized by the world shall be used. For this purpose, the operators of the heavy construction vehicles shall have necessary training and competence certificate, the working period of the workers shall be limited to 10 hours, the personal dressings and equipments of the workers shall be cared and it shall be followed up whether the personnel use the personal protective equipment such as glasses, eye gloves, hard hats and security belts etc which are provided.

Furthermore, a first aid cabinet having sufficient supplies shall be maintained within the construction site accessible easily by everybody against the accidents to occur.

In order to minimize these impacts, the liabilities specified in the section "Responsibilities of the Employer" within the 2nd Section of the "Regulation on Occupational Health and Safety" effective upon publishing in the Official Gazette dated 09.12.2003 and numbered 25311 shall be fulfilled and all mandatory measures shall be taken within the Regulation. The factors generating contamination such as possible emission and noise during the ground preparation and construction phase are examined in Section V.1 in detail and were assessed according to the effective regulations.

V.1.15 Assessment of the Traffic Load and Associated Impacts due to Transportation In and Out of the Project Site

In the extent of the study called Highways and State Roads Traffic Volume Map realized by the Highways General Directorate, Program and Monitoring Department, Transportation and Cost Studies Office, the traffic volume of E90 Highways is as follows:

Automobile	: 2.915 vehicle / day
Commercial Vehicle averagely loaded	: 353 vehicle / day
Bus	: 120 vehicle / day
Truck	: 1.025 vehicle / day
Truck + Trailer, Towing vehicle + side trailer:	159 vehicle / day
Total	: 4572 vehicles / day.

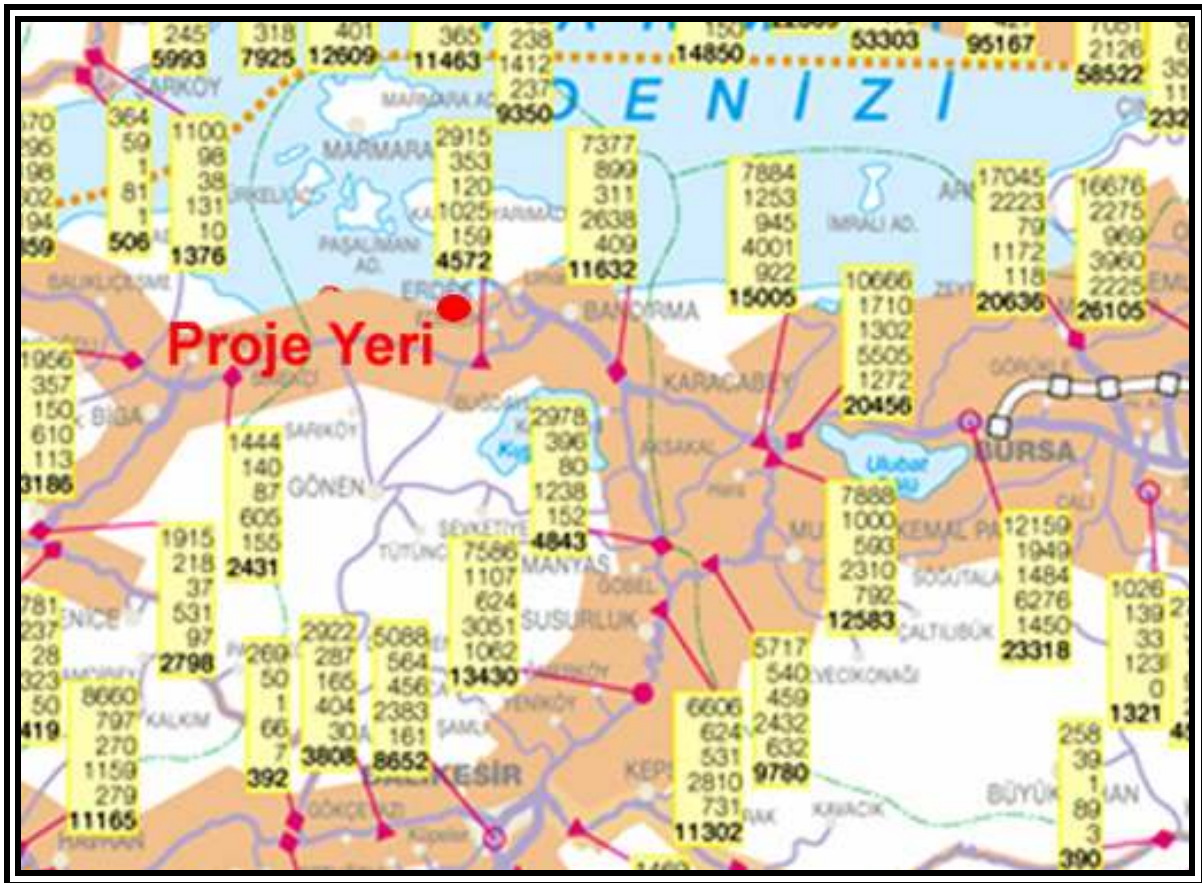


Figure V-2. Traffic Volume Map of the Region

The total traffic volume on E90 Highways is 4572 vehicles / day, the total volume is expected to be 4587 vehicles /day with the addition of 15 vehicles / day additional load upon commissioning of the Power Plant. As a result, the current traffic volume of E90 highways will increase at a rate of 0.32%.

V.1.16 Area Arrangements to be Made In Order To Create Landscape Elements or For Other Purposes (Forestation, Arrangements Of Green Areas Etc), The Species of Vegetation And Tree Etc. to be Selected For Those Works

In the areas apart from the roads and plant units to be situated within the Project, the creation of open and green areas shall be possible. The vegetation works to be made for these areas shall be in accordance with the landscape planning principles. In the landscaping work, in order to establish an arrangement between the human and nature, it is aimed to perform the most suitable arrangement in the frame work of technical, economical and aesthetic conditions. The vegetation works to be made during the operation of the Plant shall be done by considering the area usage. These shall be formed by the mixture of the shrubs and long bush groups that will not hinder the view particularly in the perimeter of the administrative buildings in order not to limit the usage within the Project area. The spatial property of the area is orientative in vegetation.

Upon the seed mixtures suitable for the soil of the region in formation of the green areas and laying grass layer, the brush and other type of planting shall be made. In the arrangement of the green areas, the climate, soil, insolation and irrigation, maintenance possibilities are the most important criteria to be considered. Furthermore, these properties shall be considered in the types selected against the fire in the site and its risks. Selection of needle types will lead to a visual richness in the sense of protecting the green structure also in winter.

During the operation period of the facility, as there will be no maintenance other than periodical maintenance, it is determined to select types with low maintenance requirement and tolerance. Furthermore, considering the regional climate properties, it is planned to perform the vegetation works during the suitable period of the year.

The vegetative soil removed during the construction phase of the Project, shall be used for the areas where the vegetation with landscape purposes is to be made.

At first stage, the vegetable soil shall be readied for planting with the types that will adjust to the region by mixing fertilizers. Later on, the planting of the shrub type vegetables shall be sieving, so that a transition from the grassy area to the forest area shall be ensured and an effective cover is ensured. At the tree types, the types with low maintenance requirements and that will ensure the structure of the soil shall be prioritized. At the second phase, the adjustment of the plants to the soil is controlled and in case of positive results, the planting of the trees shall start.

The plant types to be used in landscaping shall be selected from the domestic and foreign species that will adjust to the Bandirma District. In order to ensure the naturally aesthetic, easily maintained and economical landscaping, the integration of the above mentioned terms shall be ensured. The names of the trees and bushes to be used in the Project are given in the following.

Table V-5. The Plant Species to be used in the Landscaping Arrangements within the Projects

Species	Species
<i>Armeniaca vulgaris</i>	<i>Cheiranthus cheiri</i>
<i>Elaeagnus atlantica</i>	<i>Prunus domestica</i>
<i>Abies nordmanniana</i>	<i>Cerasus avium</i>
<i>Picea glauca</i>	<i>Pyrus communis</i>
<i>Thuja occidentalis</i>	<i>Malus sylvestris ssp. mitis</i>
<i>Salix babylonica</i>	<i>Juglans regia</i>
<i>Taxus baccata</i>	<i>Acer saccharinum</i>
<i>Pinus brutia</i>	<i>Cornus alba</i>
<i>Pinus pinea</i>	<i>Cotoneaster horizontalis</i>
<i>Albizia julibrissin</i>	<i>Lolium sp.</i>
<i>Acacia dealbata</i>	<i>Juniperus oxycedrus</i>
<i>Acacia cyanophylla</i>	<i>Juniperus sabina</i>
<i>Hedera helix</i>	<i>Magnolia grandiflora</i>
<i>Rosa centifolia</i>	<i>Phillyrea latifolia</i>
<i>Cupressus sempervirens</i>	<i>Laurus nobilis</i>
<i>Chrysanthemum leucanthemum</i>	<i>Erica arborea</i>
<i>Sarcopoterium spinosum</i>	<i>Alcea rosea</i>
<i>Lavandula angustifolia</i>	<i>Arbutus andrachne</i>

V.1.17 Other Activities

There are no other issues to be discussed under this topic.

V.2 Activities during the Operation Phase of the Project, Impacts on Physical and Biological Environment, and Mitigation Measures to be Taken

The activities during the operation of the Project, effects over the physical and biological environment and the measures to be taken are detailed in the subtitles.

V.2.1 Characteristics of the Project Units, Explanation of Activities to be Carried Out in Units, Unit Capacities, Detailed Process Flow Charts, Basic Process Parameters, Descriptions of Processes, Services to be Provided in Other Auxiliary Units, Features of Project Machinery, Vehicles, Tools and Equipment

Maximum 175.000 cm³/h natural usage shall be realized in the Project of Bandirma NGCCPP.

The unit capacities within the Project scope (operation phase);

Gas Turbine (GT1): 303,3 MWe

Gas Turbine (GT1): 303,3 MWe

Steam Turbine (ST): 324.2 MWe

The properties of the units within the Project scope (operation phase);

Gas Turbine – Generator Group:

There are two natural gas fired gas turbine – generator sets at the Natural Gas Combined Cycle Power Plant of Bandirma. Each Gas Turbine – Generator Set consists of the following units:

- Turbine
- Hydrogen cooled Generator,
- Compressor,
- Fuel System,
- Firing System,
- Cooling System,
- Oiling System,
- Control – Instrumentation System,
- Heat Isolation,
- Sound Isolation,
- Main transformer and auxiliary transformer and necessary auxiliary equipments.

Steam Turbine – Generator Set:

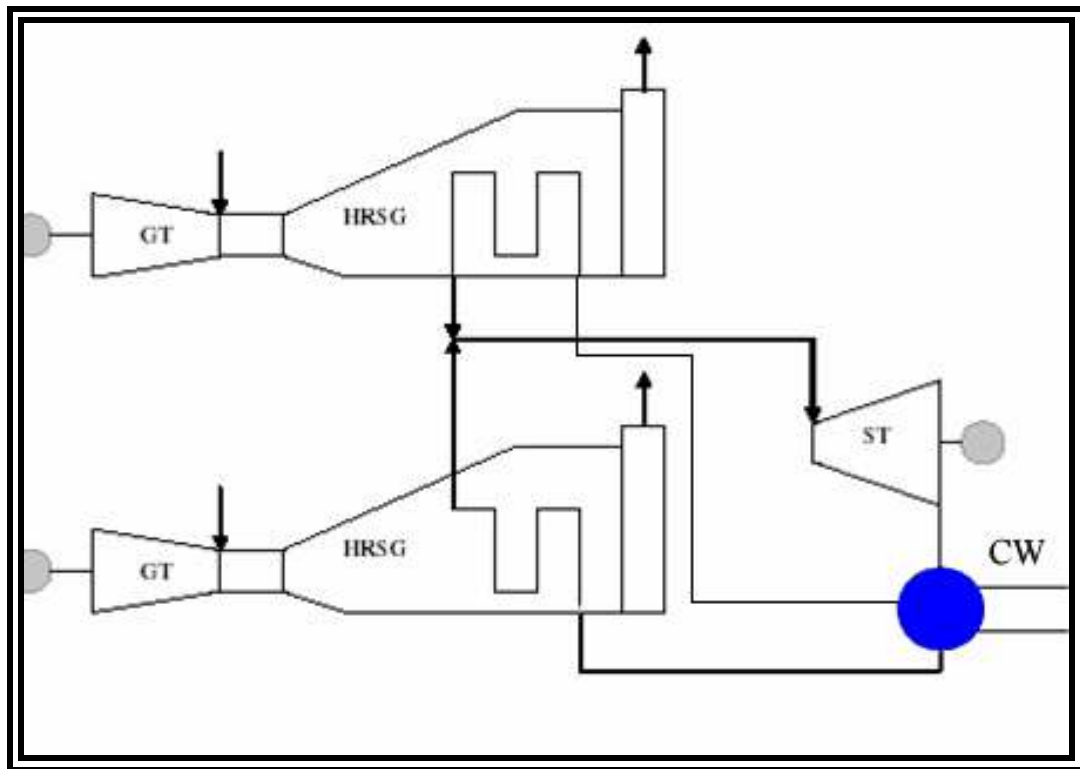
Condensation type steam turbine – generator set within the Project consists of the following units;

- Steam Turbine,
- Hydrogen Cooled Generator,
- Oiling System,
- Leakage System,
- Control – Instrumentation System,
- Heat Isolation,
- Sound Isolation,
- Main transformer and necessary auxiliary equipments and installation.

It shall be equipped with by-pass Power Plants for high, medium and low pressure stages.

Heat Recovery Steam Generator

Two units of Heat Recovery Steam Generator with three pressure stages shall be installed to the Natural Gas Combined Cycle Power Plant of Bandirma. Each boiler is comprised of gas inlet pipes, evaporator pipes, heater and super heater pipe sets, domes, safety valves, feed water pipes, exhaust stack, control and instrumentation units and steel encasing.



(GT:Gas Turbine-HRSG: Heat Recovery Steam Generator-ST:Steam Turbine-CW:Cooling Water)

Figure V-3. Schematic Diagram of the Units belonging to Bandirma NGCCPP

Electricity is generated by means of gas turbine – generator sets and steam turbine - generator sets at the Natural Gas Combined Cycle Power Plants. The heat energy obtained by the combustion arising from the usage of natural gas as a fuel within the gas turbines is converted into kinetic energy and the kinetic energy is converted into electricity by means of the generators. The transfer of the heat of the exhaust gas arising from the combustion in the gas turbines to the water in the Heat Recovery Steam Generator leads to the generation of steam having high pressure and temperature values. The steam generated as a result of this recovery process is converted into electricity within the steam turbine – generator groups. The steam arising from the steam turbine is condensed and converted into water. Indirect condensers work with heat exchange principle, the steam passes around the pipes where the cooling water passes and thus the steam is condensed. The condensed water accumulated at the lower section of the condensers is pumped back to the boiler for re-evaporation. The steam generated in the boiler is transferred to the steam turbine and cycle goes on. Cooling water system, water treatment system, pressurized air system etc. are auxiliary systems within the Plant.

V.2.2 Products and/or Services to be Produced, Amounts of The Products and By-Products, Where, In What Quantity and How These Products Will Be Marketed; The Services, Where and How to Supply the Services and the Size of the Beneficiary Population

The main product of the plant shall be the electricity. The generated electricity shall be given to TEIAS network by means of the 380 kV transmission line connecting the

transformer center to the current electricity network. The distribution of this electricity shall be done by TEIAS.

Upon satisfaction of the internal power requirements of the Bandirma NGCCPP, whole of the remaining power is planned to be sold to TETAS pursuant to the Power Sales Contract to be executed.

The yearly total power generation will be 7.300.000.000 kWh approximately. It is intended to cover the power requirements of the region considerably by means of the 7.300.000.000 kWh electricity to be generated yearly at Bandirma NGCCPP Project.

The electricity generated at the steam turbines and gas turbines shall be amplified to 380 kV level and to be connected to the national interconnected power network. The connection to the Interconnected Network is planned as input – output to EUAS Bursa NGCCPP – Can Thermal Power Plant 380 kV Power Transmission Line. In order to determine the output location of the Interconnected Power Line, necessary applications to TEIAS General Directorate were made (see App. 21). The single line scheme ensuring the intended connection to the Bandirma NGCCPP Transmission System is given in the App. 22.

The preliminary permission has been obtained from TEIAS regarding the connection points of the Bursa NGCCPP – Can Thermal Power Plant with 380 kV Power Transmission Line is taken, and Connection Agreement with TEIAS General Directorate is made.

V.2.3 Transportation and Storage of the Raw Material and Auxiliary Products and Associated Potential Impacts, The Quantity and Capacity of the Transportation Vehicles, Preparation and Elemental Analysis of Raw Material

The main raw material to be used at Bandirma NGCCPP shall be natural gas. It shall be supplied from Greece Natural Gas Main Transmission Line of BOTAS passing from 3 km south of the Project area. The natural gas shall be brought to this plant with a branch to be separated from this line. The pipe line between BOTAS main pipe line and plant shall be designed according to BOTAS Standards. The corporate remark received from BOTAS regarding the natural gas to be used for the Plant is given in the App. 23.

As described in the General Layout Plan of the Plant given in the App. 6, Maximum 175.000 cm³ per hour natural gas shall be transferred to a pressure reduction and measurement Power Plant outside of the NGCCPP area and then to the Plant by means of a connection pipe line. As the connection pipe line, pressure reduction and measurement Power Plant shall be designed and constructed by ENERJISA as per BOTAS Standards according to the agreement executed between ENERJISA and BOTAS, there shall be no negative impact during the transfer of the natural gas. Natural gas storage facility is not foreseen in the Project.

Elemental Analysis of the Natural Gas

The elemental analysis assessment of the natural gas is given in Table V-6.

Table V-6. Elemental Analysis of the Natural Gas

Chemical Composition	% Mol.
Methane	Min % 82
Ethane	Max. % 12
Propane	Max. % 4
Buthane	Max. % 2,5
Penthan and other hydrocarbons	Max. % 1
CO ₂	Max. % 3
O ₂	Max. % 0,5
Nitrogen	Max. % 6
Sulphur	-
H ₂ S	Max. 5,10 mg/m ³
Mercapton Sulphur	Max. 15,30 mg/m ³
Total Sulphur	Max. 110,00 mg/m ³

Natural Gas Upper Thermal Value;

Maximum thermal value of the natural gas is 10.427 kcal/m³ and minimum is 8.100 kcal/m³.

(m³:15°C and at 1,01325 absolute pressure, the volume of 1 m³ gas)

The provisions set forth in the "Regulation on Hazardous Chemical Agents and the Control of the Products" effective upon publishing in the Official Gazette dated 11.07.1993 and nr 21634 regarding activities related to the storage, handling and usage of the hazardous and dangerous agents during construction and operation phase and "Regulation on the Control of Hazardous Agents" effective upon publishing in the Official Gazette dated 14.03.2005 and numbered 25755.

V.2.4 Amount of the Water to be Used In the Units of the Project Will Be Used For Which Processes, Where and How It Will Be Procured, Preliminary Processes to be Applied At The Water (covering the units of purification and the units into which the water will be added as adding-feeding water), water preparation primary current schema

Amount of Water to be used in the Process;

The domestic and industrial based service water requirements for the Plant, the requirements for raw water, boiler feed water and cooling water to be provided from Marmara Sea shall be satisfied for Bandirma NGCCPP.

To prepare the boiler feedwater, some part of the sea water shall be transferred to Desalination and Demineralization unit. The most of the desalinated water out of

desalination unit shall be transferred to demineralization unit. The demineralized water to be stored in the demineralized water tank shall be used firstly as boiler feedwater and then for chemical solution preparation and chemical washing purposes. The remaining desalinated water shall be stored at the raw water tank and the service water of the plant shall be covered when necessary. The sea water to be used as cooling water shall pass through single - pass cooling cycle and it shall be discharged to the sea regardless of any chemical process. The details of the desalination and demineralization system are given in the following.

Desalination Unit

The desalination unit is the treatment unit ensuring the desalination in order to use the sea water in the process. There is series of pre-treatment process within the desalination system in order to condition the sea water ready for passage through the membrane cycle operating with reverse osmosis principle. Pre-treatment process starts with the sieves at the inlet of the water intake structure to be constructed inside the sea. The purposes of these sieves are to hinder the entry of sea livings to the system during water intake and not to harm the sea ecology and not to cause any biological blockage within the system. Furthermore, a control system determining and warning about the layers arising from all types of oil and hydrocarbon to occur on the sea surface is also a part of the pre-treatment system. Then, disinfection shall be made by the chlorination system over the sea water passing through thin sieves. The sea water disinfected and separated from large particles is desalinated by passing through the reverse osmosis membrane cycle to remove the salination. There are two different water flows at the outlet of reverse osmosis unit. First is the desalinated sea water and second is the densely salinated waste water called concentrated brine. This waste water shall be transferred to return cooling water discharge line. The residue chlorine and other chemical residue amounts within the waste water out of membrane cycles shall be continuously monitored and the values given in WPCR shall be ensured to be complied.

To cover the requirement of the plant from the sea, the water amount to be taken for desalination purposes is 90 m³ /hr. At the end of desalination, 65 m³/hr concentrated brine shall form as waste water. The 22 m³/ hr amount of the desalinated water to be obtained as product from the desalination unit shall be transferred to the demineralization unit and 3 m³/hr amount shall be stored at the pre-treated water storage tank to be used as service water.

Demineralization Unit

The demineralized water shall be required for the service requirements such as boiler feeding, drinking and usage, chemical washing and solution preparation of Bandirma NGCCPP. The product water obtained in the desalination unit as raw water in the demineralization unit shall be used.

For this purpose, 22 m³/hr water shall enter to the demineralization unit. The impurities and minerals within the desalinated sea water shall be removed and proper demineralized water compliant with the process usage shall be prepared. Currently, the desalinated water subjected to the pre-treatment and pre-disinfection shall pass from the reverse osmosis membrane and mixed ion exchange bed. The air blowers, feeding pumps, heaters, ion exchanger columns, HCl tank and pumps, NaOH tank and pumps, neutralization pool and pumps and necessary measurements and control instruments shall be available at the demineralization unit. HCl and NaOH systems shall be at separate rooms and the drainage of collection pit under the tanks shall be connected to the neutralization pool. Neutralization shall be done according to pH meter measurements and the pH shall be kept between 6 and 9. The waste water shall arise from the reverse osmosis and regeneration in the demineralization unit. These waters shall be collected at the neutralization tank by means of discharge and collection canals to be constructed for Water Treatment Building and be conditioned ready for discharge. The waste water requiring treatment beyond neutralization shall be transferred to the waste water treatment system and shall be treated with a proper treatment method according to the waste characteristics.

The reverse wash and regeneration waste water arising from water softening, demineralization and regeneration along with active carbon washing and regeneration facilities shall be conditioned ready according to the criteria given in WPCR Table 20.7 and then be transferred to the general drainage of the plant system.

An application shall be made to the Ministry according to "Guideline on Deep Sea Discharging" prior to system construction for "Project of Deep Sea Discharging" approval. Furthermore, the limit values given in the Table 22 and 23 of WPCR shall be complied for deep sea discharge of the cooling water.

V.2.5 Amount of waste water to arise from the all units of the Project, its physical, chemical and bacteriologic characteristics, parametrs to be eliminated in waste water purification facilities and with which processes and at which rates they will be eliminated, how much and how waste water will be given to receiving environments after purification processes

Domestic Waste Water Treatment Facility

During the construction phase of the Plant, package treatment system shall be used. The Project approval of this treatment system to be established shall be made within the context of "Project Approval Scope" numbered 2005/5. During the operation phase, a 10 m³ / day per capacity domestic waste water treatment unit is planned to be used to allow a service for a population of 100 persons. The ventilated biological treatment technique shall be used in the domestic waste water treatment facility. In this process, there shall be physical treatment, sedimentation and ventilation systems available. Ventilation system shall be used for defragmenting the organic contaminants of

the microorganisms of the active sludge system by ensuring sufficient amount of recycled oxygen.

The discharge from the domestic waste water treatment system shall comply with the criteria given in Table 21.1 of WPCR. The treated domestic waste water shall be collected with the discharge of cooling water conditioned to the values specified in WPCR Table 9.6 and then be discharged to the sea.

The sludge amount to arise from the domestic waste water treatment facility is at negligible amounts and be collected periodically. The treated sludges shall be analysed and disposed according to the Hazardous Wastes Control Regulation effective upon publishing in the Official Gazette dated 14.03.2005 and numbered 25755.

Table V-7. Measurement and Discharge Information of the Wastewater

Waste Water	Discharge	Measurement	Remark
Continuous			
Cooling Water	Marmara Sea	T,m	From condenser and cooling water system
Neutralization Tank	Marmara Sea	Ph,T,m	Heat Recovery Steam Generator
Interrupted			
Neutralization Tank	Marmara Sea	Ph,T,m	
GT Tank	Transportation with Trucks		
Fire Extinguishing System	Marmara Sea		
Domestic Waste Water	Septic Tank		
Surface Water Drainage	Marmara Sea		

As the cooling water is disinfected, it shall not have bacteriological contamination. Residue chlorine level shall be less than 0.5 ppm. The chemicals that have self-fragmentable formulation in the nature shall be used if required in the usage of corrosion and anti scalant. It shall not differ from the crude sea water taken from the water intake structure in terms of physical and chemical properties. As cooling tower is not used, no chemical additives such as zinc, nickel or borate is to be required. Furthermore, as there is no cooling tower, there is no evaporation loss, water driplet emission and hot air discharge.

There shall be no bacteriological contamination in the waste water arising from neutralization tank. According to the corrosion and lime inhibitor type to be used in the Heat Recovery Steam Generator, the water to be discharged from Heat Recovery Steam Generator shall be neutralized. In order not to create any alg explosion or eutrofication due to excess nutrients in sea environment, the phosphate amount to be used in boiler water additive shall be balanced i the neutralization tank and discharge criteria shall be ensured. The acidity and alkalinity originating from the regeneration water of the ion exchange beds and reverse wash water of the mechanical sand and active carbon filters shall also be balanced in the neutralization tank. According to the parameters observed in the control system of the Water Treatment Building, waste water requiring advance

treatment shall be transferred to the treatment system to be constructed and be satisfied for discharge criteria.

The waste water originating from the chemical cleaning made prior to the commissioning of the systems, chemical cleaning of any equipment, wet conservation operations are considered within the context of special waste water. The waste water to originate from such type of processes shall be collected and treated properly or the waste materials shall be transported to the facilities by trucks where such type of wastes can be disposed.

The discharge channels shall be made for rain and surface water within the plant area. If the surface waters within the Power Plant take the oil contaminants inside their structure, they shall be discharged upon treating the oil by separating process at the oil scraper traps. It is not possible for such type of water to include any hazardous contaminant other than suspended solids (SS), oil and grease.

In the tables between Table 5 and Table 21 within the WPCR, the "sectoral" discharge limits are presented for various waste water types to be discharged to the surface waters. The discharge standards to be applied over the discharge lines of various waste water arising from Bandirma NGCCPP and the criteria required to be controlled in these lines are given in Table V-8 and V-9.

Table V-8. WPCR (Table 20.7 Sector: Water Softening, Demineralization and Regeneration, Active Carbon Washing and Regeneration Facilities)

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
Chloride (Cl)	mg/l	2000	1500
Sulphate (SO ₄)	mg/l	3000	2500
Iron (Fe)	mg/l	10	-
Fish Bio-experiment (ZSF)	-	10	-
pH	-	6-9	6-9

Pursuant to article 37 of WPCR "The highest administrative chief of the location is authorized for all types of waste water discharge to the receiving water environment". The necessary permits shall be taken in this respect.

Table V-9. WPCR (Table 21.1 Sector: Domestic Type Waste Water – Class 1: Contamination Load as Raw BOD day time 5-60 kg population: 84-1000)

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
Biochemical Oxygen Demand (BOD)	mg/l	50	45
Chemical Oxygen Demandt (COD)	mg/l	180	120
Suspended Solid Agent (SS)	mg/l	70	45
pH		6-9	6-9

The discharge values of Bandirma NGCCPP shall comply with the waste water discharge criteria given in the Regulation on Pollution for Surface Water and Surroundings Caused Due to Hazardous Material published in Official Gazette dated 26.11.2005 and numbered 26005.

Waste Water of Process

Waste waters generated by the processes can be classified as; cooling water discharge, boiler feed water boiler, waste water from desalinization unit, regeneration and back wash water arising from demineralization unit, chemical washing and rain and surface water collections. All discharged channels will be given to the general waste water collection system of the Power Plant after complying with the criteria of table given in WPCR. Cooling waste water is the continuous flow with high flow rate arising from process. There will be no additives of chemical agents to the cooling water, the except disinfection agent. During the recycle of the cooling water, temperature, flow rate and amount of residual halogenes will be monitored continuously and discharged according to the limit values of WPCR. There will be no heavy metals, hazardous chemicals and suspended solid waste in the remaining waste water arising from the process, rather than the acid-base waste. Basic and acidic waste water generated from boiler, chemical wash water and demineralization unit flows through the demineralization and the mix-bed filtered unit to the Neutralization Tank. Neutralization produre is performed by controlling the pH. Neutralized water is pumped by the discharged to the waste water channel. Capacity of the neutralization tank will be 2.2 t/h.

Waste waters contain oil are not generated continuosly. This kind of waste waters will be passed thorough the 1,3 t/h capacity oil seperator system and the obtained clear water will be sent to the general discharge line of the Power Plant.

V.2.6 Information regarding cooling system (main and auxiliary cooling water) flow schema of cooling water, chemicals to be used and their amounts, effects of cooling water on receiving environments where it will be discharged and measures to be taken

Cooling Water System

The cooling water system of the Plant is comprised of the following structures:

- Cooling water intake structure,
- Cooling water intake pipes,
- Cooling water discharge pipes,
- Cooling water discharge structure.

The diameter of the cooling water intake pipe to be used in the Plant:

In case of 1 pipe, 1 x 3200 mm (water speed 1.96 m/s < 2 m/s)

In case of 2 pipes, 1 x 2.200 mm (water speed 1.85 m/s < 2 m/s)
The diameter of cooling water discharge pipe: 1 x 2.000 mm (water speed 4.8 m/s < 5 m/s)

Cooling water intake structure

Cooling water intake structure is at around -20 m deep and 200 m far away from the planned plant coastal line. There shall be grids to prevent the fish to enter the water intake structure.

Detailed data and studies related to the sea water are given in the App. 27 Report for Water Modeling Studies.

Current Data:

Maximum cooling water flow: 54,000 m³/h. (15 m³/sn)

Cooling water intake pipes

Cooling water intake pipes are connected to the water intake head around 200 m away from the coastal line and shall ensure the transmission of the cooling water to the pump building. The nominal diameter of the pipe is around 2,200 mm (2.2 m) and its length is associated with the location of the water intake head and cooling water pump building. The said pipes are planned to be buried at least 1 m deep from the surface.

Current Data

Number of water intake pipe	: 2 units
Maximum cooling water flow	: 54,000 m ³ /h (15 m ³ /sn)
Maximum cooling water flow at each pipe	: 27,000 m ³ /h (7.5 m ³ /s)
Maximum speed	: 2 m/s

Cooling water discharge pipes.

Detailed data and studies related to the sea water discharge pipe are given in the App. 27 Report for Water Modeling Studies.

Current Data:

Maximum cooling water flow rate is 54,000 m³/hr (15 m³/s)

Cooling water discharge structure - Diffuser

The diffuser structure at the end of the discharge pipe of the cooling water provides the dispersion of the discharged cooling water in the sea water. Discharge

system is comprised of the discharge pipe and the diffuser mounted at the end of the discharge pipe.

Discharge Data:

Number of water discharge pipe: 1 unit

Maximum cooling water discharge flow: 54,000 m³/hour (15 m³/s)

In the area where the cooling water will be discharged, there is no activity or sectoral study for any other projects.

Salination:

The total salination rate at the cooling water is around 2,024,640 kg/hr and the salt amount received from reverse osmosis in the desalination is around 3,400 kg/hr and it shall be discharged with cooling water. By adding the salt amount taken as a result of desalination to the cooling water, the change in the salination shall be at negligible level.

V.2.7 Fuels and Auxiliary fuels amounts to be used in the scope of the Project will be burned, and the burning systems to be used, emissions, additive amount depending on current air quality, decreasing measures and their performances, tools and systems to be used for measurements, method used in modelling study, definition of the model, meteorologic data used in modeling (precipitation, wind, atmospheric stability, height of mixture etc), inputs of model, result of model to be considered the scenario of bad situation, probable and remaining effects, recommended measures, displaying the outputs obtained as a result of modeling on land using map, characteristics of filters to be used, maintenance of filters, measures to be taken in case of failure

The natural gas to be used at the Plant as fuel shall be supplied from Turkey - Greece Natural Gas Main Transmission Line constructed by BOTAS and passing from 3 km south of the Project Site. As described in the General Layout Plan of the Plant given in the App. 6, maximum 175.000 cm³ per hour natural gas shall be transferred to a pressure reduction and measurement station located outside the Natural Gas Combined Cycle Power Plant area then to the Power Plant by means of a connection pipe line. As the connection pipe line, pressure reduction and measurement station shall be designed and constructed by ENERJISA as per BOTAS Standards according to the agreement to be executed between ENERJISA and BOTAS, there shall be no negative impact during the transfer of the natural gas. Natural gas storage facility is not foreseen in the other Project. The characteristics of the natural gas are given in Table V-10.

Table V-10. The Properties of the Natural Gas to be used

Chemical Composition (<i>Molar Percentatge</i>)	
Methane (C1)	min % 82,0
Ethane (C2)	max % 12,0
Propane (C3)	max % 4,0
Buthane (C4)	max % 2,0
Pentane and other heavy hydrocarbons (C5+)	max % 1,0
Carbondioxide (CO ₂)	max % 3,0
Oxygen (O ₂)	max % 0,5
Nitrogen (N ₂)	max % 6,0
Sulphur	
Hydrogen Sulphur (H ₂ S)	max 5,10 mg/m ³
Mercaptan Sulphur	max 15,30 mg/m ³
Total Sulphur	max 102,00 mg/m ³
Upper Heat Value	
Maximum	10.427 kCal/m ³
Minimum	8.100 kCal/m ³

The only main source to cause the gas emissions at the Plant Site is the gas turbine. The stack gas emissions to arise from the turbine shall be minimized by the control methods at the combustion room. The turbines to be used in the Power Plant are equipped with burning systems to minimize the exhaust gas emissions developed by advanced technology.

While the natural gas within the combustion room of the gas turbine is burnt, the nitrogen within the natural gas shall react with O₂ at specific temperature thereby forming NO_x. The formation of NO_x is easier as the combustion room temperature increases. By means of the burning systems (dry low NO_x burner) generating low NO_x derivatives at the gas turbines to be used in the suggested plant, NO_x control is ensured by reducing the combustion room temperature. According to the design criteria, 50 mg/Nm³ NO_x limit shall not be exceeded.

Turbine exhaust gases shall be discharged to atmosphere at around 85 °C after passing from the Heat Recovery Steam Generator.

In facilities where natural gas is used, NO_x emission per MWh is less than the half of the emission amount generated in the coal or fuel oil fired plants. In proportion with the power plants using fuel oil, there is a decrease at 33% in terms of CO₂ emission in question within the natural gas power plants. In this case, the natural gas fired plants generated 30% less CO₂ than fuel oil fired plants and 50% less CO₂ from coal fired plants.

The main emissions of the Natural Gas Combined Cycle Power Plant of Bandirma shall be nitrogen oxides (NO_x), sulphur oxides (SO_x), suspended solids (SS) and carbon monoxide (CO).

Nitrogen Oxides (NO_x)

It is formed in two ways in combustion process; (i) reaction of elemental nitrogen with oxigene in the combustion air in the combustion environment at high temperature (thermal NO_x), (ii) the oxidation of nitrogen within the fuel. There are not important

amounts of nitrogen in the natural gas planned to be burned in Bandirma NGCCPP. Thus, major part of the NO_x emissions shall form as thermal NO_x .

Sulphur Oxidex (SO_x)

SO_x forms as a result of oxidation of the sulphur in the fuel. SO_2 formation may dispose and control the SO_2 within the exhaust gas either by limiting the sulphur content in the fuel or upon formation. In the said plant, the main fuel sulphur content is a natural gas at a negligible level. In gas fired plants, SO_2 emission sources are generally liquid fuels.

Suspended Solid Particle (PM10)

PM10 emissions are generally related to the ash content of the fuel arising from the combustion sources. PM10 emissions are generally related to the ash content of the fuel arising from the combustion sources. However the low efficient combustion procedures can cause high quantities of soot formed by hydrocarbons not burnt essentially. The natural gas usage as fuel and provision of proper combustion conditions and PM emissions at Bandirma NGCCPP shall be minimized.

Carbon Monoxide (CO)

CO is formed by combustion of the fuel incompletely. The other reason of formation of the CO emission is not providing sufficient air / gas mixture. CO emissions are controlled by the sufficient fuel waiting period and provision of high temperature to ensure a full combustion at the combustion device. The limit value specified in the regulation for this emission shall be complied with.

Considering the worst case condition in this study, it is accepted that the gas turbines shall operate within the limit values in the "Special Emission Limits for Facilities Having High Contaminants in clause A-8 of App. 5 of the RCAPOIE effective upon publishing in the Official Gazette dated 22.07.2006 and numbered 26236 and the mass gas flows are calculated.

For the applications exceeding the total efficiency of 55% of the combined closed cycle systems;

$K = \text{Combined Cycle Efficiency} / 55$

New Emission Limit Value: $K \times \text{Current Emission Limit Value}$

Mass flow rate = New Emission Limit Value * Waste gas flow

Those formulations are used and the following CO, SO_2 , NO_2 and PM values are calculated. The total efficiency of the combined closed cycle systems of the plant is accepted as 59 %.

Waste gas flow

- Stack internal diameter 7.3 m
- Stack gas outlet velocity: 17.74 m/s
- Stack gas outlet temperature: 85.0°C
- Waste gas flow rate: 2,672,955 m³ / hr

In the extent of the design works, the said values are the design parameters given by the Supplier Companies. By means of these values and in the calculation of the waste gas flow under normal conditions (1 atm pressure and 0 C⁰ temperature), the following formulations are used

Heat Recovery Steam Generator Temperature (°C) + 273.15 = Waste Gas Temperature (K)

$$\text{Waste gas flow (Nm}^3\text{/hour)} = \frac{2.672.955 \text{ m}^3 / \text{saat} \times (273,15 \text{ K})}{85 \text{ }^0\text{C} + 273,15 \text{ K}}$$

$$\cong 2.040.000 \text{ Nm}^3 / \text{saat}$$

CO value:

- K = 59 / 55 = 1.07
- Waste gas flow rate = 2,040,000 Nm³/hr
- Emission Limit Value = 100 mg/Nm³

New Emission Limit Value = 1.07 * 100 mg/Nm³ = 107 mg/Nm³

Mass Flow = 107 mg/Nm³ * 2,040,000 Nm³/hour = **218.28 kg/hr**

SO₂ value:

- K = 59 / 55 = 1,07
- Waste gas flow = 2.040.000 Nm³/hour
- Emission Limit Value = 60 mg/Nm³

New Emission Limit Value = 1,07 * 60 mg/Nm³ = 64.2 mg/Nm³

Mass Flow = 64.2 mg/Nm³ * 2.040.000 Nm³/hour = **130.97 kg/hr**

NO value:

- K = 59 / 55 = 1,07
- Waste gas flow = 2.040.000 Nm³/hour
- Emission Limit Value = 75 mg/Nm³

New Emission Limit Value = 1,07 * 75 mg/Nm³ = 80.25 mg/Nm³

Mass Flow = 80.25 mg/Nm³ * 2.040.000 Nm³/h = **163.71 kg/hr**

The conversion rate of NO to NO₂ in case of NO emission is taken as 60 % in accordance with the provisions of the Regulation. In other words, NO mass flow rate is multiplied by 0.92.

$$\text{NO}_2 \text{ Emission} = \text{NO Emission} \times 0.92 = 163.71 \text{ kg/hr} \times 0.92 = 150.61 \text{ kg/hr}$$

PM (Dust) Value:

As no limit is set for the particle agents, the soot value is used in this section of the Regulation. For the gas turbines having 10 MW or more fuel thermal power, the soot grade during the continuous operation is taken as 3 (15 % volumetric O₂) according to Bacharach scale.

As a result of the design works the PM emission to arise from the Plant is considered to be 5 mg/Nm³.

$$\text{Mass Flow} = 5 \text{ mg/Nm}^3 \times 2,040,000 \text{ Nm}^3/\text{h} = 10.2 \text{ kg/hr}$$

It is accepted that the limit values for gas turbines in the clause A-8 of App.5 Special Emission Limits for Facilities Having High Contaminants Level of the RGAPOIE effective upon publishing in the Official Gazette dated 22.07.2006 and numbered 26236. According to this, it is assumed that the concentration values in the stack for CO - 100 mg/Nm³ for SO₂ - 60 mg/Nm³ and for NO_x - 75 mg/Nm³ are continuously realized (efficiency is taken as 59%, and K value is considered as 1,07). The soot values that should not be exceeded in the regulation for particle agent are defined. For the gas turbines having 10 MW or more fuel thermal power plants, the soot grade during the continuous operation is taken as 3 (15 % volumetric O₂) according to Bacharach scale.

The height of the stack at the Power Plant is calculated in the extent of the clause 3.1 of App. 4 of the Regulation considering the PM, CO, SO₂ and NO₂ parameters.

The diameter of the plant stack is 7,3 m and the waste gas temperature discharged from this stack is 85.0 °C the volumetric flow of the waste flue gas at non-humid condition and under normal conditions is 2,040,000 Nm³/hr, the mass flows of the contaminant agents arising from the emission source are 10,2 kg / hr for PM, 130,97 kg / hr for SO₂ and 218,28 kg /hr for CO. The factors used in the determination of the stack height is 0,2 for PM, 0,2 for SO₂, 15 for CO, and 0,15 for NO₂ in the extent of the Regulation.

NO₂ emission is considered due to the fact that it has the highest Q/S value (1004) in the calculation of the stack height.

Table V-11. Determination of the Stack Height

Parameter	Clarification	Value
d [m]	Stack Internal Diameter or Diameter equivalent to the Stack cross-section area	7,3 m
t [°C]	Waste Gas Temperature at the inlet of the Stack	85,0 °C
R [Nm ³ /hr]	The Volumetric Flow of Waste Flue Gas non-humid and under normal conditions	2.040.000 Nm ³ /hr
Q [kg/hr]	Mass flows of the Air Polluting Agents arising from the Emission Source	10,2 kg PM/ hr
		130,97 kg SO ₂ / hr
		218,28 kg CO/ hr
		150,61 kg NO ₂ / hr
S	The Factor used in determining the Stack Height	0,2 (PM)
		0,2 (SO ₂)
		15 (CO)
		0,15 (NO ₂)

The plant stack height for NO₂ emission is determined by using the chart as 35 m in the extent of regulation³.

The stack height specified by using the chart is (H') 35 m. This average height from the facility surface of the rough terrain at 10 H' (350 m) or according to the facility surface within the region having 10 H' radius of the maximum building heights determined according to the Settlement Plan, height average is taken as 5 (J') m. $J' / H' (5/35)$ is calculated as 0,143 and by means of the following chart, J/J' value is determined as 0,5. J value is calculated as 2.5. In this case, the corrected stack height is;

$$\text{Determined as } H = H' + 2.5 = 35 \text{ m} + 2.5 = 38 \text{ m.}$$

The stack height at the facility is specified as 40 m. In such case, the limit values regarding the Regulation on Protection of Air Quality (RPAQ) shall be complied with. Stack height is calculated according to the App. 4.b.3 of the Regulation.

³ Air Qulatiy Modelling Report- App.2

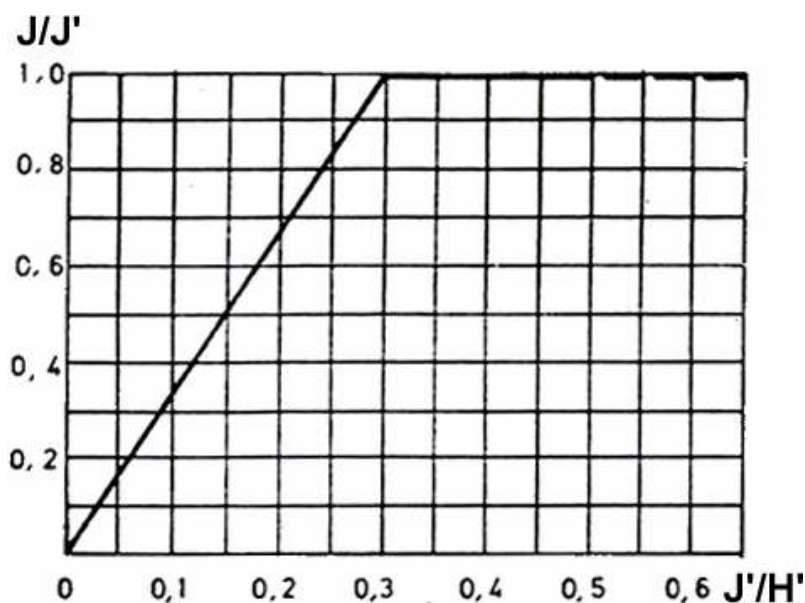


Figure V-4. The Diagram for determining the J Values

The effect of the Air pollution over the nature, climate, animals and vegetable layer is shown. The studies made put forth that air pollution generally increases the average heat in the atmosphere, lowers the wind speed, causes losses of UV rays reaching to the earth, the increase of higroscopic agents as a result of energy heating the air, speeds up the cloud formation thus changes the normal route of the precipitation. It is clear that the disruptions occurring in the climate balance due to the Air pollution shall cause extremely negative effects. On the other side, these harmful effects of the air pollution are seen in various types over the animals and plants and this case not only affects the agricultural production by also the ecological balance.

Overall Balikesir, there are many industrial branches. The air pollution caused by the Industry occurs as a result of wrong location selection, usage of improper fuel, and giving the waste gases to the receiving environment without taking technical measures.

The industrial activities in the city are classified in two groups, east and the south industrial areas. The industry in South of the City is mainly based upon heavy industry. There are also workshops dispersed among the districts of the city center and operating in various fields available. Some part of the heavy industry institutions are established at the side of intercity highways at city entries. An organized industrial zone is not available at the city, but there is an organized industry zone management executing the works to be an organized industry zone. The environmental problems arising from establishment of organized and specialized industry zones of which necessary measures are taken for the environmental protection and pollution and where the infrastructure is formed shall be overcome considerably.

The Community Health Laboratory of Balikesir is performing air pollution measurements since 1989 with a semi automatic device on the basis of SO₂ (sulphur

dioxide) and (particle agent) parameters (with the method of titrimetric method for SO₂ and Reflectometric method for PM).

Furthermore, since 1994, air quality is measured at 4 station by 8 full automatic device purchased by Presidency of Charitable Foundation for Environmental Protection in total as 4 for SO₂ measurements and 4 for PM measurements. The measurement devices for air pollution are transferred to the Provincial Health Directorate to be processed by a protocol made between the Provincial Health Directorate and City of Balıkesir, Presidency of Charitable Foundation for Environmental Protection.

The main reason of the air pollution seen in the winter months of Balıkesir are the fossile based fuels consumed to generate heat and energy. Particularly, it is caused by the burning of the 90% fossile based fuels of the sulphur dioxide (SO₂) approximately. The remaining 10% arises from the industrial activities and fuels consumed in the motorized vehicles. In fog, fuel natural sources have a share of 20%. The main reasons of the air pollution caused by heating are the usage of the unqualified fuels without any enrichment process in heating, application of wrong burning methods, non-performance of the maintenance of the used boilers periodically, can be considered.

This case presents a danger in the regions where the heating period is particularly long. Besides, the increasing population density, topographical structure and meteorological conditions, wrong settlement of the cities play important role on the increase of air pollution.

The Method used in Modeling Works:

How the subject pollutants PM-10, CO, NO₂ and SO₂ which are the pollutants that will originate from the Plant would propagate in the work area and under the existing meteorological conditions with the Modeling Works and the probable ground level concentrations that would be caused by this propagation of the subject pollutants have been examined. The propagation calculations has been realised by using the ISC3 (Industrial Source Complex) model.

The area which has a radius which is equal to 50 (fifty) times the stack heights that have been determined in accordance with the Annex-4 of the related Regulations is the affection area of the Plant. The Minimum Stack Height is 40 m and the impacted area of the Plant in this direction must be an area which has a radius of 2 km's. This area has been divided into the receiving medium element areas of 500 m x 500 m dimensions. The "Ground Level Concentrations" that are formed at the corner points of each one receiving medium elements have been calculated for a modelling period of one year with the help of the Model for NO₂, SO₂, CO and PM-10 on hourly, daily, monthly and annual bases.

The ISC3 model is one of the most developed computer models that can predict the hourly, daily, monthly and the annual Ground Level Concentrations by taking the the

real time data that changes during the course of time. The Model houses within its body the different propagation model calculations for different sources from the insulated stacks to the illegal pollutants (point, volume, line).

The ISC3 model operates in a network system that is being defined by the user and the calculations are being carried out for the corner points of each one of the receiving medium elements that form the network system. The network system that is being used by the ISC3 model can be defined in polar or cartesian methods. Apart from these, more detailed calculations can be carried out at these points which are outside the network system by determining discrete receiving points and the calculations can be carried out also at certain heights of the atmosphere in addition to the Ground Level Concentrations. The Pasquill Stability Class is being used in the propagation calculations. There is an option in the Model for also taking into consideration the rough land.

- The ISC3 model uses data in three different varieties that are specified herein below.
- The coordinates and the height of each one of the elements in the network system which is defined as the receiving medium.
- The wind direction, wind speed, temperature, Pasquill Stability Class, Mixing Height, hourly meteorological data set.
- The Source Coordinates those are determined in accordance with a starting point that is determined by the User, The Source Data that covers the Source Height, Diameter, Pollutant Exit Speed and the temperature.

The Receiving Medium Used in the Modeling:

As mentioned herein above, the defining of a work area for the ISC3 model and the separation of this area into the receiving medium elements are necessary. The area with four corners that has been defined as the receiving medium for this work has been selected so that the Plant would take place in the center. The network system covers 210 each receiving medium points of 500 m x 500 m in an area that takes place in the East – West direction.

The Meteorological Data Set Used in the Modeling:

The Meteorological hourly data set pertaining to the Bandirma Meteorological Station and the Mixing Data Set pertaining to the Goztepe Meteorological Station in the Model Works have been used.

The Source Parameters Used in the Modeling:

Those parameters that have been calculated herein above in the Modeling of the NO₂, SO₂, CO and PM-10 emissions that would originate from the Plant have been used.

The propagation Modeling Works that have been realized for each pollutant and the Ground Level Concentrations on the hourly, daily, monthly and annual bases at every one receiving medium point have been calculated and the short term and the long term effects of the subject pollutants have been examined.

The Air Quality Modeling Report that has been prepared in relation to the Bandirma NGCCPP / NATURAL GAS COMBINED CYCLE POWER PLANT Project is being represented in the Annex - 17.

Parametres	Daily (STLV)	Limit value of Regulation	Annual (LTLV)	Limit value of Regulation
PM-10 ($\mu\text{g}/\text{m}^3$)	9,61	300	2,48	150
CO ($\mu\text{g}/\text{m}^3$)	274,70	30.000	52,92	10.000
SO ₂ ($\mu\text{g}/\text{m}^3$)	164,81	400	31,75	150
NO ₂ ($\mu\text{g}/\text{m}^3$)	189,52	300	36,51	100
Settleable Particules	24,91	650	6,43	350

V.2.8 The Quantities and the Properties of the Other Solid Wastes that Would Form During the Operation of the Plant, Their Disposal, Places the Solid Wastes will be transported to or Purposes reused of Solid Wastes. The Changes that these Solid Wastes will Form in the Receiving Media, The Probable and the Remaining Effects, The Measures to be Taken

The Solid Wastes that may be formed within the scope of the Project that would originate from process will be disposed of within the frame of the related Regulations.

The amount of the Solid Wastes of residential quality that would form when the Plant is started to be commissioned will be 134 kg /day in total for the 100 persons that would be employed in the Power Plant when the unit Solid Waste production is taken as 1.34 kg / person - day. The amount of the Solid Wastes of residential quality that would form during the operation of the Plant and the industrially non-hazardous wastes will be given to the Municipality of Bandirma as a result of the protocol that is to be made by complying with the articles of the "The Control Regulations of the Solid Wastes" that has become valid by being published in the Official Gazette numbered 20814 dated 14 03 1991 on the matters of the transportation, storage and the final disposal of these.

Additionally, those domestic solid wastes that would be formed and that have the quality of being made use of in the Power Plant (plastics, metal, glass etc.) will be given to the recycling companies as licensed by the MoEF in the direction of the provisions of "The Control Regulations of the Packages and the Package Wastes" that has become valid by being published in the Official Gazette numbered 25538 dated 30 07 2004.

The related provisions of the "The Control Regulations of the Medical Wastes" numbered 25883 and dated 22.07.2005 for those Solid Wastes that would come out of the

First Aid Unit and in the Medical Aid Unit during the Civil Construction and the Operation phases will be complied with.

Those waste batteries that come out of the Plant will be collected and given to the companies as licensed in the accordance with the provisions of “The Control Regulations of the Waste Batteries” that has become valid by being published in the Official Gazette numbered 25569 and dated 31.08.2004.

V.2.9 The Vibrations that would form within the scope of the Project, The Remaining Effects, The Measures that are to be Taken, The Preparation of the Acoustic Report (That will be Prepared on Separate Basis for Each Plant) in accordance with the “The Control Regulations for the Evaluation of the Environmental Noise and Management “

The Acoustic Report in which the noise that would formed from the activities works that will be carried out in the Project area is calculated and is being presented in the Annex - 20.

The closed container and the Building where the Gas Turbine is present is not the working area. Time will be passed for period that is less than one hour during the inspection for visual control.

The Gas Turbine, the Heat Recovery Steam Generator and all other Auxiliary Plants form Noise Sources by themselves alone or together when they are operating in between their 10 % - 100 % operation capacities.

The predicted Noise Levels in the various units of the Plant and the measurement values in a similar Plant have been provided in the Table V-12. The values given in the related table have been prepared that all these noise sources are to be measured in such a way that are to be sensed at a distance of 30 m.

Table V-12. Noise Level Generated from Units of the Plant

Unit Name	Noise Level at 30 m Distance (dBA)
Heat Recovery Steam Generator Stack, with Silencer	65
Heat Recovery Steam Generator Walls	70
Gas Turbine Entrance Silencers	67
Turbines	65
Transformers	59

The Sound emission limit values that are given in the Table V-13 will be used in the design works of the Plant.

Table V-13. Noise Emission Limits

Power Plant Operation Mode	Noise Parameters	Max. Noise Level (dBA)
Under all Operation Condition	At 1 m Distance from the Source of Noise	< 85
	At Project Site Boundaries	≤ 70 *
Under all Operation Condition	At 1 m Distance from each electric motor	< 85
Noise Emissions at Temporary Periods that are not Continuous	At 1 m Distance from the outlet(s) in case of operation from the Safety Valves	115
	The Noise Level at the Power Plant Site Boundaries when the Power Plant starts and goes out of operation	90

Source: World Bank "Thermal Power Plants Pollution Prevention Hand Book"

V.2.10 Quantities and the Properties of the Radioactive Wastes, Noise Sources and the Noise Levels, The Probable and the Remaining Effects and the Proposed Measures

The formation of any radioactive wastes is not being generated in the Bandirma NGCCPP Project in the construction and in the operation phases. Due to this reason, there is not any point that should be given under this heading.

The Acoustic Report the carrying out of the evaluations that are in relation to the Environmental Noise Levels for those establishments that take place in the A and B categories of the Annex – VII List of the Evaluation and Management of the Environmental Noise and the carrying out of the calculations (measurement and calculations) and that the covers the technical measures that are to be taken based on certain standards are being provided in the Annex – 20.

V.2.11 Hazardous, Toxic, Flammable and Explosive Substances to be Used in the Project Units During Production, Their Transportation and Storage, For Which Purposes They will be used, The Hazards that may happen during their Uses and the Measures that are to be Taken

The Natural Gas will be brought to the Plant through a branchment that will be taken from the Greece Natural Gas Main Transmission Pipe Line. The storing of Natural Gas at the site will not be made. The Pipe Line in between BOTAS Main Transmission Pipe Line and the Plant will be designed in accordance with the BOTAS standards.

The entire site and the equipment will be earthed. The indicators that provide safety in the filling and unloading will be used. Some solvents that are used for the cleaning and painting the parts of various equipments take place in the Plant

The Chemical Substances that may be used within the body of the Plant will be brought to the Plant for being delivered on the spot in the Plant by trucks will only be used

by specially trained personnel. The taking of all the necessary health, safety and the security measures by the related transporters will be made to be provided.

The points that are specified in the “The Control Regulations of the Hazardous Chemical Substances and their Products” that has become valid by being published in the Official Gazette numbered 21634 and dated 11 07 1993 together with the “ The Control Regulations of the Hazardous Wastes “ that has become valid by being published in the Official Gazette No. 25755 dated 14 03 2005 on the matters of the storage, transportation and the use of the Regulation on Dangerous and the Hazardous Substances will be complied with.

V.2.12 The Determination of the Strength of the Effects on Material and the Propagation Effect on the Underground and Above the Ground Cultural and the Natural Entities in the Project Effect Area (On the Traditional Metropolitan Structure, On Archeological Remains, On Those Places that are to be Protected)

There is no Underground and Above the Ground Cultural and the Natural Entities Archeological Remains, etc. in the Project Effect Area within the Project Area and in the Effect Area. However the Works that are being conducted will immediately be stopped in case any one Archeological Remain is met and the Balikesir Culture and Tourism Provincial Management will be informed accordingly.

V.2.13 The Probable Effects On Land Flora / Fauna

The necessary measures that are to be taken for the reducing of the effect of the Plant on the natural plantation structure and on the fauna in the environment during the Civil Construction and the Operation of the Plant to the minimum possible level have been specified herein below.

Flora:

There is no endemic or a scarce variety and habitat that are under threat within the Project Area. Those endemic varieties have not been determined at the end of land work, these are the varieties that are possible to be found in the environment. However, care for the not going out of the battery limits / boundaries of the Project area during the Civil Construction and the Operation of the Plant will be taken in order not damaging the natural vegetation structure.

Fauna:

The differentiating the effect of NO_x on animals from the effect of other pollutants is rather difficult. Along with this, the being insufficient of the existing information does not suffice the determining of the effect of the quantity of the existing nitrogen oxides at the moment on animal populations. The greatest predicted concentrations remain below the standards of Turkey and the World Bank that have been developed also for the purpose of

preservation of the animal varieties along with the human health. Due to this reason, the creating of a negative effect of the proposed Combined Cycle Power Plant on the animal populations in the region is not expected. Not any chemical or biological pollution will happen in the Environment due to the substances and materials that are to be used in the proposed Combined Cycle Power Plant.

Those measures for the fauna varieties that are taken under protection in the Annex – II and in the Annex – III within the scope of the Article 6 and Article 7 of the Bern Convention that have been specified will be taken.

Article 6 (For those Varieties that take place in the Annex - II List) will cover those points:

- Especially the following points will be prohibited for these varieties.
- All kinds of seizure and keeping on purpose, the ways of murder on purpose;
- To damage the reproduction or resting places on purpose or to harm these places;
- To disturb the Wild fauna Especially during the reproduction, development and the hibernation periods on purpose in such a way that these will contradict the objectives of this agreement;
- To collect eggs from the Wild Environment on purpose or to keep these eggs even these are empty;
- The having in hand and the domestic trade of these animals either in living or dead manner, inclusive of the embalmed animals and any easily transportable parts that have been obtained or the materials in which these have been used in those cases where the provisions of this article will provide contribution to the effectivity.

Article 7 (For those Varieties that take place in the Annex - III List):

will cover those points that arrange :

- The other basics that arrange the closed hunting seasons and / or the operations,
- The prohibition of the enterprise on temporary or the regional manner in the appropriate cases for the purpose of reaching of the wild fauna to sufficient population levels,
- The arranging of the sales of the wild animals either in living or dead manner, the keeping of these in hand and transporting or presenting these for sales for the purpose of selling them.

V.2.14 Probable Effects over the Forest Areas and the Measures to be Taken Against Forest Fires

The closest forest area to the Project Site is at a distance of approximately 500 m to the east with birds flight. The necessary measures will be taken for the fires that may burst in the Power Plant area. It has been stated in the view that has been taken from the Bandirma Forest Operation Management pertaining to the Project Location that "There is no drawback in the making of the subject Power Plant since the Power Plant area is not forestry". The view of the Bandirma Forest Operation Management has been provided in the App.- 16.

V.2.15 The Effects of the Projects on Agricultural Products and on Becoming Acidic of Earth, The Methods Used in the Prediction of becoming Acidic of Earth and the Measures that are to be Taken

The getting calcined of the soils with low pH values increases the buffering capacity of the soil and hence decreases the affection of the acid rains directly in this way in certain ratios.

The plant that develops in soils that are insufficient from the point of the nutrients is more sensitive against the air pollution.

The genetic variation in trees is a factor that responds a against the air pollution.

The damage that emerges on the trees that get weaker by getting under the effect of sulphur dioxide at low quantities as a result of the getting more populated and living of the hazardous insects together with the fungi on the trees on the secondary basis may earn great dimensions by also getting also spread on the forests in the vicinity. Those gas pollutant substances in the air are effective in the photosynthesis and these affect the chlorophile.

The plants contain sulphur in their leaves and in their pointed leaves to a certain extent. The sulphur values have been determined to be also in the pointed leaves of the red pines are of 0.114 % level in the 1 year old pointed leaves on the average, whereas the sulphur values in the pointed leaves of the red pines are of 0.142 % level in the 1 year old pointed leaves on the average.

Rain decreases the affecting of SO₂ on the plants. SO₂ mixes in to the soil with the rain and hence it may give harm to the plantation.

The acidification phase is a kind of stress in the forest soils. The evaluation of the effects of the acidification phase on the forest ecosystem is dependent on the evaluation of the elasticity parameters like the buffering and the proton loss without happening of an

important change in the chemical structure of the soil. Various proton buffering types are observed in the forest soil.

Those points which are being stressed on the forest illnesses that originate from the air pollution and the acid rains have been provided herein below.

The acid accumulation in the soil causes the washing out of the plantation nourishment substances and the mobile aluminum ions give harm to the roots of the trees and following this water and plantation matter loss happen in the top parts of the trees following this.

The pressure that would originate from the air pollution especially causes the synergistic effects to emerge and causes harm in the trees at the end of the deterioration of the metabolism.

The damage symptoms cause a kind of variable factor under the soil conditions and the emissions make an effect on the plantation nourishment substances by getting synchronized under special air conditions.

The nitrogen accumulation that increases at a steady pace spoils the balance of the plantation nourishment substances in the plant metabolism and reduces the resistance to frost of the plant.

Those flue gases that contain excessive amounts of organic compounds cause the increase of the formation of the photo oxidants that contain photo toxic substances by spoiling the natural balance of the photo hormones in the trees.

Those events that may happen in the forest foliage as a combination of the acid accumulation especially in the high elevation locations may be explained the harm that occurs from the high ozone concentration in the air and from the formation of the photo oxidants, the washing out of the plantation nourishment substances, the becoming acid of the soil, the harm observed in the thin roots, the getting less of the plantation nourishment substances, the difficulty met by the trees for the supply of the water and the and the decrease in the resistance to frost of the plant.

When characteristics of the soil compare with the sensitivity it can be observed that soil samples have low sensitivities for acid accumulations. Additionally, according to the geochemical balanced models results shows, the area around the Project Site will be insensitive in terms of acid accumulation. As a result, no sizeable negative effect is being expected from the Bandirma NGCCPP / Natural Gas Combined Cycle Power Plant on the regional soil quality.

To have much of a prediction on the effect on the plantation foliage is not possible even though the values that are calculated under such information as specified herein above stay below the critical values.

As a result, when the concentrations that originate from the emissions of the ENERJISA are evaluated together with the existing plants then the total concentrations that are caused by the emissions are below the limit values that are specified in the RCAPOIE.

V.2.16 Effects On the Under Ground and Over the Ground Water and The Measures that are to be taken

Not any negative effect of the Bandirma NGCCPP / Natural Gas Combined Cycle Power Plant Project is being expected on the Under Ground and Surface Waters.

V.2.17 Effects on Marine Environment and Measures to be taken

The process and the cooling water of the Power Plant will supplied from the Marmara Sea. A part of the sea water will be sent to the Desalination and the Demineralisation Units in order to prepare the boiler feed water. Most part of the desalinated water that comes out of the Desalination Unit will be sent to the the Demineralisation unit. Whereas the demineralised water that stored in the demineralised water tank will in priority be used as boiler feed water and for the purposes fort he preparation of the chemical solutions and for the chemical washing processes. The remaining part of the demineralised water will be stored in the raw water tank and then will be used as the service water need of the Power Plant when necessary. Whereas the sea water that will be used as cooling water will then be discharged again to the sea through passing the single pass cooling cycle without subjecting the sea water to any chemical treatment at all.

There will be a rake / grid in the water intake structure for the prohibition of the sea living organisms.

V.2.18 Cumulative Evaluation of the Probable Effects of the Power Plant on the Region (On the Receiving Area like living entities, air quality, water and soil) with Existing Pollution Load

Those probable effects in the Bandirma NGCCPP / Natural Gas Combined Cycle Power Plant Project will stay at minimal level as a result of the measures that are to be taken.

Flora :

There is no endemic or a scarce variety and habitat that are under threat within the Project Area. Those endemic species that take place in the Table – 45 have not been determined at the end of land work, these are the varieties that are possible to be found in the environment. However, care for the not going out of the battery limits / boundaries of the Project area during the Civil Construction and the Operation of the Plant will be taken in order not damaging the natural vegetation structure.

Fauna

It is difficult to distinguish the influence of NO_x on animals from other kinds of pollutants. Furthermore, it is impossible to determine influence of existing amount of nitrogen oxides on animal communities due to insufficient knowledge. Estimated highest concentrations are lower than the standards of Turkey and World Bank for protecting health of both human beings and animals. Therefore, it is not expected that proposed cycle power plant will cause a negative impact on animal communities in the region. No chemical or biological pollution will arise in the region due to materials and substances to be used within the proposed power plant.

Maximum NO_2 rates to be caused by Bandirma Natural Gas Combined Cycle Power Plant are so low that no negative impact on plants will occur.

In addition to comparisons with rates in the literature, estimated environmental concentrations are also very much lower than national and international environmental air quality standards issued for protection of both human health and flora species. Therefore, it is not expected that NO_x emissions of proposed power plant will create any negative impact on plants and animals. Within the context of such a work, two negative impacts on marine species will be observed. First, living things will be also taken by cooling water in case an effective mode of filtration can not be applied during ingestion of cooling water. For this purpose, pipes to be used for drawing water from the sea will also comprise a pumping and filtration system. Pore diameters of these filters will be very low and they will operate with maximum efficiency. But yet, it can not prevent bacteria, nano and micro plankton populations to be damaged.

However, when current biological diversity of the region is taken into consideration, it is observed that it comprises endemic or not endangered species and that these species have a wide range. Although it is not possible to say that there will not be any damage, if technologies minimizing such damage are used, this long-term damage will be negligible, when we also take development of country into account.

The second possible negative impact is thermal pollution. Water temperature in each zone is determined by restrictive factors such as amount and wave length of light, period of exposure to light and hence it diversifies. Temperature in each level provides formation of different biological activity and species. If temperature of any zone changes due to any reason, living integrity in this region will also change. Thermal pollution which is known as returning of heating water to aquatic system after usage for cooling purposes, and increase in production in this respect; will be the most important and perhaps the only negative impact of such an activity on living things. However, sea water which will be heated by cooling water used within the context of activity will be equalized with the temperature of receiving zone, and hence receiving environment will not be exposed to any change.

Moreover, living things may leave the area for a while due to factors such as turbidity and noise which will arise during installation of the system. Impacts depending on turbidity are also observed due to natural seasonal cycle. Although respiratory distress will be observed for macro populations due to turbidity, this will not affect the general population and can be negligible. Species which will depart from activity area, will take cover in regions with similar ecological conditions. Furthermore, all of existent species which are determined, have a wide range within the region. Therefore, they return and resettle into the area after removal of the negative effect.

Influences on Air

The only main source of gas emissions is the gas turbine within the plant. Chimney gas emissions to be exhausted by turbine will be minimized by control measures within the burning room. Turbines to be used within the power plant, are equipped with state-of-the-art burning systems which minimize exhaust gas emissions.

While burning natural gas in burning rooms of gas turbine, Nitrogen within natural gas combines with O_2 at a certain temperature and creates NO_x . Formation of NO_x is much easier if temperature of burning room increases. By means of burning systems (dry low NO_x burner) to be used in the proposed gas turbines, temperature of burning room will be decreased and NO_x will be

Exhaust gases of turbine will be discharged to air at almost 85 °C after being passed through Heat Recovery Steam Generator.

NO_x emission per MWh in plants operating with natural gas is lower than half of the emission in plants operating with coal or fuel oil. In power plants operating with natural gas produces a CO_2 emission almost 33 % lower than power plants operating with fuel oil. Under this circumstances, power plants operating with natural gas produces 30 % lower CO_2 than power plants operating with fuel oil and 50 % lower CO_2 than power plants operating with coal.

Basic emissions of Bandirma Natural Gas Combined Cycle Power Plant will be nitrogen oxides (NO_x), sulphur oxides (SO_x), suspended particle material (SPM) and carbon monoxide (CO).

Nitrogen Oxides (NO_x)

It will be observed in two different modes during burning processes: (i) Combination of nitrogen oxygen in the form of element, within burning air under burning environment of high temperature (thermal NO_x), (ii) Oxidation of nitrogen within the fuel. Natural gas to be burnt in Bandirma NGCCPP does not comprise a considerable level of nitrogen. Therefore, a great amount of NO_x emissions will occur in the form of thermal NO_x .

Sulphurdioxide (SO_x)

SO_x comes into being as a result of oxidation of sulphur in fuel. Formation of SO₂ can be controlled either by restricting sulphur content within the fuel or by keeping and eliminating SO₂ within exhaust gas. Within the said power plant, main fuel is natural gas whose sulphur content is negligible. Generally, source of SO₂ emissions is fluid fuels within power plants operating with gas.

Suspended Particle Material (PM10)

PM10 emissions which arise in burning sources are generally related with ash content of fuel. Within this context, fuels comprising lower ash content produce lower PM10 emission. However, burning processes with lower efficiency can cause formation of a considerable amount of soot which is mainly composed of hydrocarbons. By using natural gas as fuel and providing adequate burning conditions, PM emissions within Bandirma Natural Gas Combined Cycle Power Plant will be minimized.

Carbon Monoxide (CO)

CO comes into being due to incomplete burning of fuel. Another reason for formation of CO emission is failing to provide sufficient air/gas mixture. CO emissions are controlled by sufficient standby time within burning device for fuel so as to provide complete burning and by maintaining high temperature level. Limit rate required by regulation will be applied for this emission.

Process originated solid wastes which may arise within the context of project, will be eliminated within the context of regulations.

Water Influences

As explained under article V.2.15, discharge to sea will be possible on the basis of WPCR provisions. Analyses results of WPCR Table 4 are submitted within Appendix 25.

Soil Influences

It is observed that sensitivity of soil samples against acidic sedimentation is generally low when compared to general sensitivity classification of soil characteristics. Region surrounding the power plant area will be insensitive against acidic sediments according to results of geochemical balance modeling which has been performed. As a result, it is not assumed that Bandirma NGCCPP will have a considerable negative effect on regional soil quality.

V.2.19 Evaluation of All Transportation (including Marine Traffic) Both Inside and Outside the Plant, Traffic Load and its Influences within the context of Project

When we take the distance between power plant and neighbouring settlement units and number of employees in the power plant into account, and especially when we

consider the highway next to the power plant for transportation of these employees, local traffic load will not increase considerably.

Transporters will take all current security and safety measures during shipment of all materials to be used; and their obeying with traffic rules will be provided.

Approximately 400,000 m³ of excavation will be performed and as mentioned above construction affairs will be completed within 9 months. Monthly working will comprise 26 days, and daily work will be 8 hours.

$$\text{Number of Expedition} = \frac{400,000 \text{ m}^3 \times 1.6 \text{ ton/m}^3}{9 \text{ months} \times 26 \text{ day/month} \times 8 \text{ hour/day} \times 23 \text{ ton/expedition}} = 15 \text{ expedition/hour}$$

Number of vehicles to be used for shipment and dispatch is 2; and expedition number of each truck is submitted below:

$$\frac{15 \text{ expedition/day}}{2 \text{ vehicle}} = 7.5 \text{ expedition/vehicle-day}$$

Furthermore, it is taken into account that trucks performing shipment and dispatch will also return after being unloaded; and hence 7.5 expedition/day is multiplied by two and in estimations 15 expedition/day has been used.

Traffic volume of E 90 highway is estimated as below within the context of the study titled Traffic Map of Highways and State Ways performed by General Directorate of Highways, Department of Program and Monitoring, Branch Directorate of Transportation and Cost Survey:

Automobil	: 2,915 vehicle/day
Middle Loaded Commercial Vehicle ⁴	: 353 vehicle/day
Autobus	: 120 vehicle/day
Truck	: 1,025 vehicle/day
Truck+Trailer, Tractor+Subsidiary Trailer	: 159 vehicle/day
Total	: 4,572 vehicle/day

Total vehicle volume in E 90 highway is currently 4,572 vehicle/day; and after operational commencement of power plant, an additional load of 15 vehicle/day will arise

⁴ Vehicles having a transport capacity of approx. 14-25 persons and total load of approximately between 3-5 and 10 tons.

and total traffic volume will become 4,587 vehicle/day. Consequently, power plant will cause an increase of 0.32 % in existent traffic volume of E 90 highway.

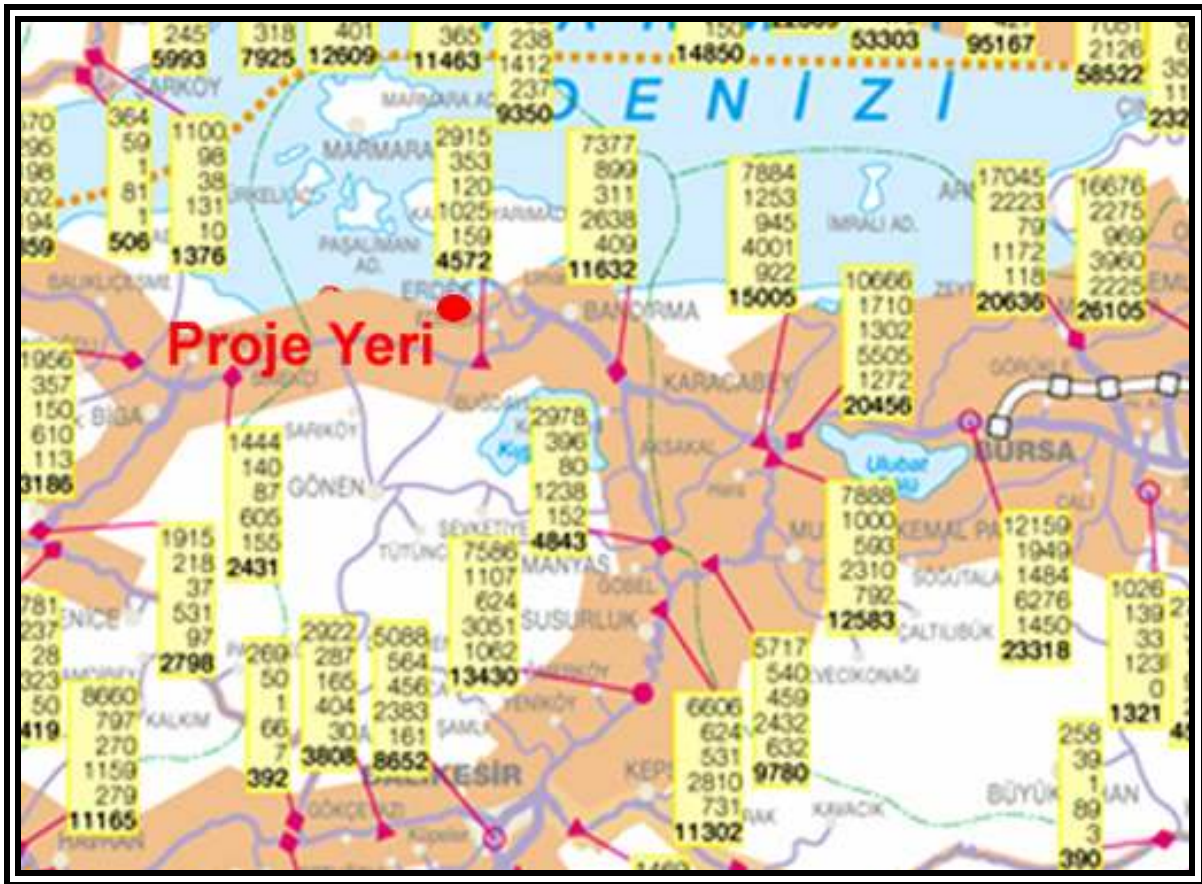


Figure V-5. The Traffic Volume Map of the Region

V.2.20 Where and how housing and/or technical/social infrastructure of the personnel and their families to work during operation of the facility will be provided

Social Units construction such as mess hall, locker building, infirmary shall be made for the personnel to work in the Project. They can cover their other social requirements from the nearby Hidirköy, Bezirci Village and Sirincavus Village.

V.2.21 Those that are risky and dangerous from the activities in the stage of operation of the Project

All wastes to arise from the planned facility shall comply with the environmental standards specified by the regulation and they shall be processed in a manner not to threaten the human life in any means.

In order to prevent all possible risks towards human health, all health and security rules specified by the regulations shall be complied.

In order to prevent the possible accidents to arise from the natural gas usage, there shall be advantage gas leakage, fire warning and extinguishing systems. Fire extinguishing systems shall not only be equipped with automatic and/or remote controlled devices, but also be equipped with manual controlled regional fire extinguishing systems.

V.2.22 Area arrangements to be made in order to create landscape elements and for other purposes

In the areas apart from the roads and facility units to be situated within the Project, the creation of open and green areas shall be possible. The vegetation works to be made for these areas shall be in accordance with the landscape planning principles. In the landscaping work, in order to establish an arrangement between the human and nature, it is aimed to perform the most suitable arrangement in the frame work of technical, economical and aesthetic conditions. The vegetation works to be made during the operation of the Facility shall be done by considering the area usage. These shall be formed by the mixture of the shrubs and long bush groups that will not hinder the view particularly in the perimeter of the administrative buildings in order not to limit the usage within the Plant area. The spatial property of the area is orientative in vegetation.

Upon the seed mixtures suitable for the soil of the region in formation of the green areas and laying grass layer, the brush and other type planting shall be made. In the arrangement of the green areas, the climate, soil, insolation and irrigation, maintenance possibilities are the most important criteria to be considered. Furthermore, these properties shall also be considered in the types selected against the fire in the site and its risks. Selection of needle types will lead to a visual richness in the sense of protecting the green structure also in winter.

During the operation period of the facility, as there will be no maintenance other than periodical maintenance, it is determined to select types with low maintenance requirement and tolerance. Furthermore, the climatic conditions of the region shall also be taken into account. It is important for the continuity of the plants, to perform the vegetation at suitable periods of the year.

The vegetative soil scraped during the construction phase of the Plant area, shall be used for the areas where the vegetation with landscape purposes is to be made.

At first phase, the vegetable soil shall be readied for planting with the types that will adjust to the region by mixing fertilizers. Later on, the planting of the shrub type vegetables shall be made, so that a transition from the grassy area to the forest area shall be ensured and an effective cover is ensured. At the tree types, the types with low maintenance requirements and that will ensure the structure of the soil shall be prioritized. At the second phase, the adjustment of the plants to the soil is controlled and in case of positive results, the planting of the trees shall start.

The plant types to be used in landscaping shall be selected from the domestic and foreign species that will adjust to the Bandirma District. In order to ensure the naturally aesthetic, easily maintained and economical landscaping, the integration of the above mentioned terms shall be ensured. The names of the trees, bushes and trailings to be used in the Project are given in the following.

Table V-14. The Vegetable Types to be used in Lanscaping Arrangements at the Project Area

Types of the Vegetable	Types of the Vegetables
<i>Armeniaca vulgaris</i>	<i>Cheiranthus cheiri</i>
<i>ElArus atlantica</i>	<i>Prunus domestica</i>
<i>Abies nordmanniana</i>	<i>Cerasus avium</i>
<i>Picea glauca</i>	<i>Pyrus communis</i>
<i>Thuja occidentalis</i>	<i>Malus sylvestris ssp. mitis</i>
<i>Salix babylonica</i>	<i>Juqlans regia</i>
<i>Taxus baccata</i>	<i>Acer saccharinum</i>
<i>Pinus brutia</i>	<i>Cornus alba</i>
<i>Pinus pinea</i>	<i>Cotoneaster horizontalis</i>
<i>Albizzia julibrissin</i>	<i>Lolium sp.</i>
<i>Acacia dealbata</i>	<i>Juniperus oxyElArus</i>
<i>Acacia cyanophylla</i>	<i>Juniperus sabina</i>
<i>Hedera helix</i>	<i>Magnolia grandiflora</i>
<i>Rosa centifolia</i>	<i>Phillyrea latifolia</i>
<i>Cupressus sempervirens</i>	<i>Laurus nobilis</i>
<i>Chrysanthemum leucanthemum</i>	<i>Erica arborea</i>
<i>Sarcopoterium spinosum</i>	<i>Alcea rosea</i>
<i>Lavandula angustifolia</i>	<i>Arbutus andrachne</i>

V.2.23 Recommended Distance for Band of Health Protection

The Facility is located at the 1st Class GSM Type of the regulation related to the Office Opening and Operation License. 1. During the location selection and facility installation license for Class GSM licenses, the commission was specifying the health protection band distance. However, the EIA Positive Certificate for the facility of which has an EIA Report arranged is accepted as the location selection and facility installation license. 10 m health protection band from the facility borders within the Project shall be left and there shall be no construction or work on this area.

V.2.24 Other Activities

There are no items to be clarified under this title

V.3 Impacts of the Project on Socio-Economic Environment

The impacts of the Project over socio-economical environment are detailed under the sub-titles.

V.3.1 Expected Income Increase, Employment Opportunities to be Created, Migrations, Education, Health, Cultural and Other Social and Technical Infrastructure Services and Changes in the Use Conditions of These Services, etc as a Result of Realization the Project

There shall be an income increase by the completion of the Project and commissioning. The income of the employees of the Facility and the commercial services received from the environment (accommodation, food and clothing consumption etc) shall put an income to the regional economy. Thus, the personnel to work in the Facility shall create an employment possibility for the people living closeby settlements and the community in Bandirma District. Thus, there shall be an income level increase in the region. The economical input shall be considerably high during the construction.

The main contribution of the facility to the country and regional economy shall be ensured by the procurements in return for the usage of the generated power. 700 persons shall work in the facility during construction and 100 persons during the operation.

There shall be an infirmary at the facility. The small accidents to occur at the facility during operation and in cases where urgent attention is needed, this health center shall be used. The other health requirements of the employees at the Plant, shall be provided by the available health institutions.

The education infrastructure at the region is sufficient due to the close proximity of the Project Area to the Bandirma District and other settlements.

V.3.2 Environmental Cost-Benefit Analysis

The main raw material to be used at Bandirma NGCCPP shall be natural gas. As described in the General Layout Plan of the Plant given in the **App. 6**, Maximum 175.000 cm³ per hour natural gas shall be transferred to a pressure reduction and measurement Power Plant outside the natural gas power plant area then to the plant by means of a connection pipe line. As the connection pipe line, pressure reduction and measurement Power Plant shall be designed and constructed by ENERJISA as per BOTAS Standards according to the agreement executed between ENERJISA and BOTAS, there shall be no negative impact during the transfer of the natural gas. Natural gas storage facility is not foreseen in the Project.

The emission amount to be given out the environment shall be reduced with this Project. The essential environmental costs and benefits of the Project are given in the Table V-15.

Table V-15. Main Environmental Costs and Benefits of the Project

Main Benefits	Main Costs
Annual 7.300.000 kWh power generation with the latest technology to be used	Biomass loss in the field can realize.
The excavation materials to occur in the Construction phase shall be used as filling material in the field and in the arrangement of the green areas.	There may be countless of impacts over the social services and the infrastructure.
Realization of power generation in a modern and clean facility compliant with the environment.	
Provision of low cost and reliable power	
Clean, safe and efficient power generation	
Minimizing the losses incurred during power transfer.	
Providing employment possibility to the regional people (700 persons during Construction phase, 100 during operation phase)	
The benefits including indirect employment and local work possibilities.	

VI. THE POSSIBLE PERMANENT IMPACTS AFTER DECOMMISSIONING PHASE AND THE ASSOCIATED MITIGATION MEASURES

VI.1 Rehabilitation and Recreation Activities

In the areas outside the facility units and roads within the facility during the construction phase, green areas shall be formed in the Bandirma NGCCPP as a first priority. By these green areas to be formed, the facility area shall have a proper area quality with its environment visually.

The vegetation Works shall be done as described in detail in the Section V.2.22 and the functionality and visual quality criteria shall be observed. The vegetation Works to be made during the Operation phase shall be the final vegetation.

VI.2 Impacts on the Water Resources

During completion of the operation activities, the discharge of any process water without any mandatory treatment shall not be possible. Thus, no impact is expected on the current water sources.

Furthermore, no negative impact is in question in terms of vegetation layer.

VI.3 Possible Air Emissions

By the completion of operation activities, no emission shall be in question to the environment. Thus, no impact is expected on the current air quality.

VII. ALTERNATIVES OF THE PROJECT

(The comparison of alternatives for site selection, technology, measures to be taken will be made, and preference will be mentioned)

The following potential sources and systems can be used in satisfying the power requirements.

- Renewable Sources (Hydroelectric power plants, geothermal, wind and sun),
- Combined Cycle Power Plant,
- Gas Turbines (Open Cycle),
- Nuclear Power Plants,
- Coal fired Thermal Power Plants,

It is seen that, other renewable sources except the hydroelectric power plant among the power sources and systems planned as technological alternatives of the Project, cannot satisfy the power requirements. For hydroelectric power plants, the first investment costs are high, the construction period is long and the area they cover is large. Thus, hydroelectric power plants can be considered only for medium and long term power plans. It is unfavorable for Turkey to be dependent solely upon the hydroelectricity plants in power supply in terms of operational safety. It is widely known that Gas Turbines and Natural Gas Combined Cycle Power Plants have minimum negative impact over the environment.

The power generated by the natural gas combined cycle power plants is the cleanest generation type after renewable energy. It has superiority over the coal fired power plants in terms of flue gas emissions for environment.

The gas turbines and combined cycle plants which have short construction and commissioning periods can be taken into operation in a short period. Such facilities are compact and cover very small area.

In terms of covering the short term power deficit, natural gas plants are preferred due to low NO_x emission and environmental friendly technology investment.

Flue gas treatment facilities are required to reduce the flue gas emissions occurring in the coal fired thermal plants to the regulation limit values. Furthermore, as the construction and commissioning periods of the coal fired power plants are fairly long, it is a proper alternative covering the requirements in medium term.

Location Selection Criteria and Alternatives

For the location selection works of the natural gas combined cycle power plant intended to be constructed, as the sea water shall be used as cooling water, being at close proximity to Marmara Sea is an important factor. Besides, it is also another reason

for the selection of the location the close proximity to the natural gas pipe line route. Mainly these two factors and the following criteria in the selection of location are taken into account:

- Position according to the transportation system,
- Dominant wind direction,
- Geological and seismic conditions,
- Topographical conditions,
- Land ownership status,
- Connection to the power transmission system,

These criteria were taken into account and the selection of the Project location was selected.

Hence, no other alternative is considered related to the location.

VIII. MONITORING PROGRAM

(Emergency response plan and monitoring program for construction phase, operational phase (stack gas, air quality, wastewater, noise, aquatic environment, quarry site, etc) and after implementation)

The Monitoring Program and Emergency Action Plan intended to be realized related to the Bandirma NGCCPP Project are detailed under the title of VIII:1.

VIII.1 Recommended Monitoring Program for Construction, Operation and Post-Operation Activities and Emergency Action Plan

In the extent of the planned Project, the environmental monitoring program proposed for Project construction and operation periods, operation of the activity (flue gas emissions, air quality, waste water, noise, sea ecology etc) and in the framework of the environmental monitoring program and the emergency intervention plan proposed for post-operation, shall be periodically executed upon either during the ground preparation and construction period or in the operation period and besides upon the closing of the activity for operation. Firstly, in connection with a Final EIA Report, an Environmental Monitoring and Management Plan (EMMP) shall be prepared and this plan shall be presented to the MoEF with the relevant institutions.

On the issue whether the commitments are fulfilled related to the initial and construction period of the Project investment (until the transition to the operation period), the “Final EIA Report Monitoring Report Forms” given in the App. 4, and “Circular for Competence Certificate” effective upon publishing in the Official Gazette dated 24.02.2004 and nr 25383 is to be filled in specific periods defined by the Commission and be delivered to the MoEF.

The titles towards the environmental monitoring program suggested to be within the EMMP to be prepared in the Project scope are generally described in the following sub-titles.

Construction Period Monitoring Program

The environment air quality shall be monitored during the construction activities of the planned Project. In this respect, it is suggested to perform the dust measurements.

The calibration adjustments of the passive sampling tubes to be established shall be made with the calibration gases having international monitorability certificate.

The Monitoring Program suggested for the Construction Period

The following terms shall be taken into account in the construction phase generally:

- * The execution of the construction in compliance with the contract plan and technical specifications,
- * The inspection of the construction quality competence and keeping all types of records related to the construction,
- * The execution of the construction in compliance with the final Project documents and drawings prepared during the implementation phase,
- * Fulfilling the requirements of Labor Health and Safety Regulation.

Apart from these, in order to reduce the effects of the construction over the environment, it is necessary to perform monitoring pursuant to the applicable legislation. The monitoring areas in the construction phase are the areas where the construction is made, contractor's site, plant area and construction area rehabilitation fields.

In order to specify the potential changes in the soil quality within the same period, it is planned to take soil samples from the plant area and to determine the chemical and physical properties of the samples.

In the construction period, in order to determine the regional noise level, the noise measurements shall be made at the closest settlement area.

The outlet water quality of the domestic package treatment facility to be used during construction activities shall be monitored. The pH, SS, BOD and COD parameters shall be monitored monthly. During the construction activities, no impact is expected on the quality of the surfacial and underground waters.

The storage of the vegetable soil scraped from the plant area, the landscape arrangement after construction and whether they are suitable for other purposes shall be controlled.

Monitoring Program during Operation

During the planned Project operation phase, the flue gas emissions to arise from the plant activities, surface level concentrations, cooling water sample analyses (monthly), regional soil quality analysis (annual) and diversity in the sea ecology (twice a year) shall be continuously monitored.

All monitoring works shall be done by the institutions having a competence certificate from the Ministry and in accordance with the standard techniques proposed by the MoEF. The calibration of the diffusion tubes located near the field shall be controlled continuously.

In the extent of the operation phase monitoring program, the water intake and waste water discharges shall be monitored continuously in terms of parameters proposed in the WPCR.

During operation phase, the domestic waste water shall be monitored monthly in terms of pH, SS, BOD and COD parameters.

Process waste water will be monitored at the sea discharge line and will be reported twice a year in the monitoring report. Monitored parameters will be, flow, PH, conductivity, left halogen (chlorine) and temperature. Beside these, continuous measurement equipments will be placed to the effluent of every single unit and pH, conductivity, silissium and dissolved oxygen levels will be monitored. For the boiler feed water phosphate level will be monitored additional to other monitored parameters.

In the extent of the area arrangement and landscaping works upon the commissioning of the Plant, the usage of the previously scraped and stored soil shall be considered mainly and necessary controls shall be made during implementation.

NOx and PM emission sedimentation to arise from the Plant during operation shall be monitored with the ground level concentrations, the soil samples shall be taken from the points where the accumulation is suggested to be the highest in the modeling works and acidity shall be monitored by pH measurements.

During operation phase, it shall be monitored whether the regulations are observed for the noise measurement either at the plant area or at the closest settlement.

Monitoring Program after Operation

After the completion of the Plant activity, the cooling water intake shall cease from the sea. However, the monitoring program suggested for the operation phase shall continue for a period of one year seasonally. In case of negative events, the corrective and preventive measures shall be taken forthwith.

Emergency Action Plan

No natural gas storage activity shall be done at Bandirma NGCCPP. The natural gas shall be transferred to the facility through the pipe line of BOTAS, the pipe line can be closed with valves whenever necessary and facility entry and emission to air shall be prevented during emergency. The chemicals to be used within the Facility shall be stored on the impermeable surfaces in enclosed areas and only be used and handled by the specialists. Thus, the direct hazard occurrence related to the storage and usage of chemical agents is extremely less.

The plant is equipped with general control system and has a high automation system. The electronic hardware to be installed at the control building shall be under computer control and as a result of the generation work; all units shall be controlled and managed. The main advantage of the control system is to inform the system operator about any problems immediately by means of alarm during operation. Thus, any problem

shall be either immediately removed or the problematic unit or process can be put out of system without being exposed to any danger.

The personnel to be employed within the Plant shall attend the seminars where they are to be trained on the first aid, fire intervention, chemical agent leakage or spills at the storage areas by the specialists. These seminars shall be repeated in specific intervals and the employees shall be subjected to feedback on the new information and to make them remember what they had forgotten.

While task distribution is made in the facility, in case when an emergency intervention is required, the tasks of each personnel at the shifts shall be notified at the facility. In cases requiring the emergency intervention and the measures to be taken in such cases, shall be prepared in a report and this shall be used during training and emergency intervention of the personnel.

Furthermore, the provisions of the Law nr 5312 regarding the Emergency Intervention in Contamination of the Sea Surrounding by Petroleum and Other Hazardous Agents and Principles for the Compensation of the Losses shall be complied.

Fire Extinguishing and Protection System

- The person who sees the fire first, shall initiate the alarm by pressing the closest alarm button.
- Fire Brigadier shall be notified.
- The foam extinguishers shall be brought to the point of fire hastily and safely.
- Fire motor pumps shall be operated.
- The piping safety and door security shall be provided.
- The personnel untasked in the fire teams, shall gather at the collection points.
- The fire shall be reported to the authorized contact unit at the central Office.
- First aid shall be provided to the injured.

All types of fires occurring at the facility shall be immediately intervened. For this purpose, the mobile fire extinguishing devices shall be used. These devices shall be supplied, installed, preserved, controlled and used in accordance with the provisions given in the Section 1 called Security Measures to be taken against the fire in the offices and in the

Section 5 related to the Security Measures to be taken to prevent working accidents and the devices to be available.

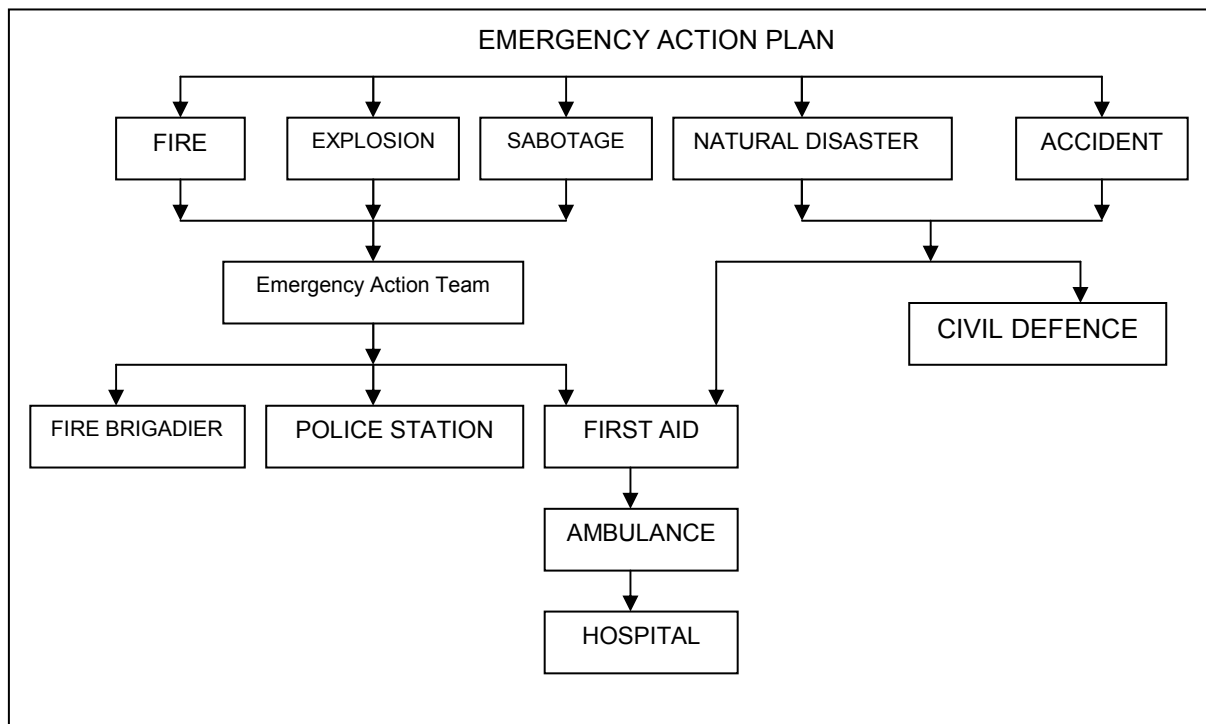


Figure VIII-1. Emergency Action Plan

The measures to be taken during the Earthquake

- The entry and exit Gates of the Facility area shall be under the control of the security guards.
- The natural gas line can be closed with valves whenever necessary and in emergencies; entry to the facility and emission to air shall be prevented.
- The personnel working in enclosed areas shall gather at safe points close to them.
- The Personnel shall await the orders of the Emergency Supervisor at the gatherance point and act accordingly.
- Information shall be taken on the intensity and location of the earthquake.
- Information shall be taken from the Official Institutions regarding the aftershocks.
- If it is determined that no danger is observed, the works in the facility shall start part by part.

The Measures to be taken for the Liquefaction Risk

To reduce the liquefaction risk on a surface where the liquefaction potential is high, one or more of the measures such as transferal of the foundation loads by boring piles to other surface having no liquefaction potential, stabilization with cement or lime according to the location and position, stabilization with stone and sand piles, vibrofloatation, surface or dynamic compaction shall be applied.

In case of occurrence of any emergencies such as work accidents, flooding, earthquake, fire etc in the Project Area, the first person aware of the event shall warn the other units by means of the alarm within the facility. First of all, the relevant institutions (hospital, fire brigadier, police etc) shall be informed and the arrival of the response team on the site shall be provided. In cases where medical intervention is required, necessary medical intervention shall be made by the health personnel and first aid teams at the facility until arrival of the response team and the survivor shall be ensured to arrive at the health center immediately.

VIII.2 In case that EIA positive certificate is given, then program in connection with realizing the matters in second paragraph of title of "Obligation of the Establishment/Organizations that obtain competence certificate" in Competence Communiqué .

Related to the performance of the project at intervals to be specified by the MoEF until the facility operation upon the receipt of the EIA Positive Certificate in accordance with the provisions of Competence Circular shall be filled to the form at the Competence Circular, and be presented to the MoEF, EIA and Planning General Directorate, Monitoring Inspection Office.

IX. CONCLUSION

(General summary, list of important environmental impacts and assessment for prevention from adverse environmental impacts upon realization of the Project, making selection among Project's alternatives and reasoning)

It is planned to establish "Bandirma Natural Gas Combined Cycle Power Plant" having an established capacity of 930.75 MWe at Balıkesir, Bandırma, Sirincavus, Hacılibey location by ENERJISA. The plant shall be constructed over an area of 20 ha out of a total 204 ha. The yearly total power generation will be 7.300.000.000 kWh approximately. It is intended to cover the power requirements of the region considerably by means of the 7.300.000.000 kWh electricity to be generated yearly at Bandırma Natural Gas Combined Cycle Power Plant Project. The purpose of Project is important.

A license for 49 years is taken for the said project from the Energy Market Regulation Authority (EMRA).

The lifetime of Bandırma Natural Gas Combined Cycle Power Plant of Bandırma is planned to be around 25 years.

Balıkesir Environment Layout Plan (ELP) works with 1/100.000 scale covering the Project are executed by Governorate of Balıkesir (Special Provincial Administration) and approvals are on-going. In this extent, the accord shall be ensured between the 1/100.000 scale plan decisions not approved by the relevant Administration and the plans to be prepared at lower scale for the activity area.

40% of the investment shall be provided by the internal resources, and for 60%, a foreign credit shall be used.

Brown forest soil of the large soil groups at the Project area has an slope of 20-30%, and takes place at the 6th class land competence class subjected to medium intensity erosion at medium depth.

The natural gas to be used at the Plant as fuel shall be supplied from Greece Natural Gas Main Transmission Line constructed by BOTAS and passing from 3 km south of the Project area.

The service water requirement to be used at the Plant shall be provided by the pre-treated water storage tank. The service water used shall be passed oil separator through the general drainage system and be connected to the cooling water discharge system by means of the system where the rain and surface waters are collected.

As a result of the morphological, geological and geotechnical works, there is no area improper for construction at the inspection area. It is observed that the inspection area is formed by pebbled and sandy clays belonging to the Neogene series completely. As there is no problems such as settlement, expansion, liquefaction, insufficiency for

carriage according to the laboratory results and SPT results where the Neogene sediments, the inspection area is included in to the areas suitable for settlement.

The low level of underground waters in the Project area and due to the permeable structure of the rocks, no liquefaction is expected. However, the regulation related to the Project to be realized shall be complied and studies shall be made.

The domestic and industrial based service water usage for the Plant, the requirements for raw water, boiler feedwater and cooling water to be provided from Marmara Sea shall be satisfied for Bandirma NGCCPP.

To cover the requirement of the plant from the sea, the water amount to be taken for desalination purposes is 90 m³/hour. At the end of desalination, 65 m³/hour concentrated brine shall form as waste water. The 22 m³/hour amount of the desalinated water to be obtained as product from the desalination unit shall be transferred to the demineralization unit and 3 m³/hour amounts shall be stored at the pre-treated water storage tank to be used as service water.

The service water requirement to be used at the Plant shall be provided by the pre-treated water storage tank. The service water used shall be passed oil separator through the general drainage system and be connected to the cooling water discharge system by means of the system where the rain and surface waters are collected.

The solid wastes to arise from the Works up to commissioning of the units starting from the ground preparation of the planned plant and construction phase, domestic solid wastes to arise from the employees, solid wastes to arise from the construction materials, waste oils to arise from the working vehicles and sludge from the treatment plant can be classified as wastes.

There is no tree cutting in question due to the Project area bearing the field property. The only impact for the plant types that is the biomass loss shall be limited due to the scraping of the vegetable soil layer. Upon the completion of the ground preparation and construction phase, these types shall form the previous layer by means of vegetative bodies such as the seed, bulbs, rhizome etc available in this vegetable soil.

The main product of the plant shall be the electricity. The generated electricity shall be given to TEİAS network by means of the 380 kV transmission line connecting the transformer center to the current electricity network. The distribution of this electricity shall be done by TEİAS.

There is no under ground and above ground cultural and natural assets within the Project area and influence area. However, in case of finding any archaeological remnants during the works for ground preparation and construction phase, the works shall be stopped immediately and be notified to Balıkesir Culture and Tourism Provincial Directorate.

X. PUBLIC PARTICIPATION

(How and with which methods the domestic people probably affected by the project was informed, views of the people about the Project and explanations related to the issue)

After the Public Participation Meeting to the EIA Process held on 27.11.2007 and Information, Scope and Special Format Determination Meeting held on 04.12.2007, the special format intrinsic to the activity of MoEF, EIA and Planning General Directorate is given and this report is prepared in accordance with the said format.

Methods used for Public Participation to the EIA Process

In the extent of the Regulation for Environmental Impact Assessment effective upon publishing in the Official Gazette dated 16.12.2003 and 25318, a Public Participation Meeting to the EIA Process was held on 27.11.2007 at 14.00 in Bezirci village to inform on the project and to take their remarks and proposals. In order to ensure the participation of the public to this meeting where the activity and environmental effects of the activity, an advertisement was put on two newspapers, one local and one national newspaper.

The employment possibilities created by the Project as well as its contribution either to this country and region, it was well accepted.

The Concern, Remarks / Proposals and Assessments of the Community related to the Subject

The project intended to be realized is informed by the project preparing Company at the Public Participation to the EIA Process Meeting to the regional community. The environmental effects of the activity and the measures to be taken accordingly (the measures desired by the Public) are committed in the relevant sections within the report.

Upon the Public Participation to the EIA Process Meeting on 04.12.2007, the Meeting for informing the MoEF, Scope and Special Format Determination was held. After the said meeting, the special format intrinsic to the activity of MoEF, EIA and Planning General Directorate is given and this report is prepared in accordance with the said format.

The Concern, Remarks / Proposals and Assessments of the Parties consulted related to the Subject

On 04.12.2007, the Meeting for informing the MoEF, Scope and Special Format Determination was held. The remarks of the commission members attending to the meeting related to the Project were taken and this report was prepared accordingly.

APPENDICES (Those form information, documents and technics used preparing the report and provided from different organizations that are not included into the text of report)

- App.-1.** ENERJISA-Keas Merging Contract
- App.-2.** Ownership Certificate
- App.-3.** License Acceptance Remark
- App.-4.** 1/25.000 scale Topographical Map
- App.-5.** The satellite photograph showing the location of the plant and its surroundings
- App.-6.** General Layout Plan
- App.-7.** Time Schedule of the Project
- App.-8.** Meteorological Data
- App.-9.** 1/25.000 scale Geological Map
- App.-10.** Geological – Geotechnical Report
- App.-11.** Live Fault Map
- App.-12.** Map of Land Assets
- App.-13.** Commitment (Agriculture)
- App.-14.** Oceanographical – Hydrographical Report
- App.-15.** Stand Map
- App.-16.** Bandirma Forest Operation Office Letter
- App.-17.** Air Quality Modelling Study
- App.-18.** Treatment Facility Plan
- App.-19.** Plankton Analysis
- App.-20.** Acoustic Report
- App.-21.** TEIAS Corporate Remark
- App.-22.** Single Line Scheme
- App.-23.** BOTAS Corporate Remark
- App.-24.** Photos related to the Project site
- App.-25.** WPCR Table 4- Analysis
- App.-26.** Balikesir Provincial Agriculture Department Remark
- App.-27.** Water Modelling

The provisions of the following directives, regulations and laws shall be complied during construction and operation phase of Bandirma NGCCPP Project;

- Labor law numbered 4857,
- Land Hunting Law numbered 4915,
- General Public Hygiene Law numbered 1593,
- Underground Waters Law numbered 167,
- Rehabilitation of Olive Planting and Vaccination of the Wild Olives Law numbered 3573 and dated 26.01.1939
- Environment Law numbered 2872 and enacted based upon this law;
- Regulation on Package Wastes Control dated 24.06.2007 and numbered 26562

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- Regulation on Medical Wastes Control effective upon publishing in the Official Gazette dated 24.06.2007 and 26562,
 - Regulation on Waste Battery and Accumulator Control effective upon publishing in the Official Gazette dated 31/08/2004 and 2569,
 - Regulation on Waste Oil Control effective upon publishing in the Official Gazette dated 21.01.2004 and 25353,
 - Regulation on Environmental Impact Assessment effective upon publishing in the Official Gazette dated 16.12.2003 and 25318,
 - Regulation on Assessment and Management of Environmental Noise effective upon publishing in the Official Gazette dated 01.07.2005 and 25862,
 - Regulation on Control of Air Pollution Originating from Industrial Establishments effective upon publishing in the Official Gazette dated 22/07/2006 and 26236,
 - Excavation Soil, Construction and Debris Waste Control Regulation effective upon publishing in the Official Gazette dated 18.03.2004 and 25406,
 - Labor Health and Safety Regulation dated 09.12.2003 and numbered 25311,
 - Regulation on Business Opening and Working License dated 10.08.2005 and numbered 25902,
 - Regulation on Solid Waste Control Regulation effective upon publishing in the Official Gazette dated 14.03.1991 and 20814,
 - The Regulation on the Tanks that will not be constructed where Sewer System Construction is not Applicable effective upon publishing in the Official Gazette dated 19.03.1971 and 13783,
 - Regulation on The Tanks that will be Constructed where Sewer System Construction is not Applicable
 - Regulation on Waste Water Control effective upon publishing in the Official Gazette dated 31.12.2004 and 25687,
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 - The Regulation for the Control of the Exhaust Gas Emissions arising from the Motorized Land Vehicles cruising at the traffic effective upon publishing in the Official Gazette dated 08.07.2005 and 25869,
 - Hazardous Chemical Agent and Product Control Regulation effective upon publishing in the Official Gazette dated 17.02.2005 and 25730,
 - Regulation on Occupational Health and Safety dated 11.01.1974 and numbered 14765,
 - The Directive on the Measures to be taken at the places and offices where Inflammable, Explosive and Dangerous and Hazardous Agents are used effective upon publishing in the Official Gazette dated 24.12.1973 and 14752,
 - The Directive regarding the procedures and principles for the Import, Handling, Storage, Sales, Usage, Destruction and Supervision of Explosive Materials, Hunting materials and similar on the Measures to be taken at the places and
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offices where Inflammable, Explosive and Dangerous and Hazardous Agents are used effective upon publishing in the Official Gazette dated 29.09.1987 and 19589, yet removed from Tekel products.

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INTRODUCTION OF THE PROJECT TEAM PREPARING THE EIA REPORT

Project Owner	Enerjisa Energy Generating Inc.
Name of the Project	Bandirma Natural Gas Combined Cycle Power Plant
The location of the Project	Balikesir City, Bandirma District, Sirincavus Village, Hacialibey
Prepared by	Serdar Environmental Engineering and Waste Management Contruction Industry and Trading Ltd. Co. Dokay Engineering and Consultancy Ltd. Co.

The personnel to be employed as per relevant article of the Communique	Name Surname	Profession	Responsible Section, PAge, Section, Addenda etc.
Environment Engineer (5-a)	Nesibe YILMAZ	Environment Engineer	Section V.2.10
Graduate Personnel from Faculties of Engineering and Architecture (5-b)	M.Haldun SEZER	Electrical Engineer	Section V.2
	Bulent BAYRAKTAROGLU	AdvanEIA Mining Engineer	Section IV.2.2
Other Personnel	Mehtap DİLEK	Geology Engineer	All Sections
	Oznur TUGCU	Landscape AdvanEIA Architect	Section IV.2.8 Section IV.2.12
	Mehmet Emin AYDOGAN	Chemical Engineer	Section 5.2.3
	Esra Elif AYDIN	AdvanEIA Biologist	Section 4.2.12
	Oge MUTAF	Environment Engineer	Section V.2.7
Report Coordinator (5-c)	Eyup KAYA	Business Administration	All Sections

The CV, diploma, signatory circular and chamber registration documents of the personnel preparing the EIA report are given after the addenda.

