KIRIKKALE COGENERATION POWER PLANT PROJECT

NON-TECHNICAL SUMMARY

APRIL 2013
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1. INTRODUCTION

Seymenoba Elektrik Üretimi A.Ş., (Seymenoba) a subsidiary of AES-Entek Elektrik Üretimi A.Ş. (AES-Entek) plans to construct a Cogeneration Power Plant (CPP) having an installed capacity of 233.7 MWe adjacent to the existing Tüpraş Refinery located in Kırıkkale. Project Site is on the southwest of Kırıkkale province and about 10 km distant from the city center of Kırıkkale on Kırıkkale-Kırşehir Road (see Figure 1).
The plant will mainly serve to meet steam consumption and electricity demand of the Tüpraş refinery. The surplus generation will be supplied to the national mains through 154 kV transmission line (Since Hacilar Substation is located adjacent to the Project Area, transmission line shall be a few meters long).

The Project is included in the scope of the paragraph (a) (the thermal power plants and other incineration systems having a total thermal power of 300 MWt) of the Article 2 of Annex-1 (List of the Projects Subject to Environmental Impact Assessment (EIA)) of the Regulation on Amendment to the EIA Regulation published in the Official Gazette numbered 27980 and dated 30.06.2011 since it has a thermal power of 404 MWt.

Seymenoba applied to Energy Market Regulatory Authority (EMRA) on 14.02.2012 to obtain a generation license for the proposed Project.
2. INFORMATION ON THE PROJECT OWNER AND THE CONTRACTOR

The owner of the Project is Seymenoba, which is a subsidiary of AES-Entek\(^1\). AES-Entek is a subsidiary of Koç Holding, where Koç Group is Turkey’s largest group of companies with operations particularly in energy, consumer durables, automotive and finance sectors. Group is the impulsive force of Turkish economy with revenue that constitutes 7% of Turkey’s GNP, and an export volume that constitutes 8% of Turkey’s total exports. As of 2012, Koç Holding is the only Turkish company in Fortune 500, at 222\(^{nd}\) place.

AES-Entek’s shareholder AES is a Fortune 200 international energy company, with diverse electricity generation facilities based on thermal and renewable energy sources as well as electricity distribution assets, and 29,000 employees, providing sustainable energy to 27 countries at favorable prices. AES’ revenue in 2010 is 16 Billion dollars, and its total assets are 41 billion dollars.

AES-Entek has appointed Técnicas Reunidas Group as the turnkey EPC Contractor, a Spanish-based general contractor engaged in engineering, design and construction of industrial and power generation plants, particularly in the oil and gas sector.

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\(^1\) As of December 2010, US-based AES became a shareholder of Koç Group’s electricity production company Entek A.Ş.
3. PROJECT DESCRIPTION

3.1 Plant Specifications

The installed power of the Project is 233.7 MWe (electrical power output) / 404 MWt (thermal power output) and it is anticipated to generate a power of 2,030,000,000 kWh per year. The Plant is being established to supply the surplus power to the national grid through 154 kV and to serve the steam and electricity needs (maximum 38 MWe) of Tüpraş Refinery. Kirikkale CPP will consist of two (2) gas turbines with Gas Turbine exhaust bypass stack, two (2) heat recovery steam generators (HRSGs) with co-firing, one (1) steam turbine, two auxiliary boiler (conventional incineration boiler 95 MWt) blocks, as well as three (3) generators and a distributed control system (DCS). There will be four (4) stacks for the Project; two (2) of them belongs to steam boilers and other two (2) will be installed after HRSG units (one for each unit).

At the operation stage, the CPP is anticipated to consume about 300,000,000 m³ natural gas in average in a year. Natural gas will be supplied from the BOTAŞ PRMS station, which is to be constructed about 1200 meters away from the Project Site, or the branch of the station which is located at South border of Tüpraş Refinery. Natural gas supply system will be decided according to further engineering works by the Project Owner.

The cooling type selected for the CPP is wet cooling system and the water to be used for cooling purposes will be supplied from Kapulukaya Dam. Since Tüpraş has financed the construction of Kapulukaya Dam, it is entitled to use 6% of the water. Seymenoba has a protocol with Tüpraş to use this water which has been approved by State Hydraulic Works.

The chlorinated and filtered water will be taken from tanks and treated in the demineralization unit and then be added to the system to compensate the loss of the auxiliary steam system and the water-steam cycle.

Effluent water will be treated before being combined and discharged to the Kızılırmak River. Buried pipe and outfall will be installed to control the discharge to the existing Refinery discharge route. Discharge parameters will comply with the limits values set forth by national and international regulations/standards.

The proposed CPP will run on natural gas. In the event that any major natural gas interruption or any extraordinary situation occurs at the plant or if it is not possible to supply natural gas, diesel oil will be used in gas turbine for ensuring the electricity and safety of Tüpraş. Nevertheless, in case of any problem, limited amount of steam will be generated by using fuel oil (fuel oil no: 4) in the auxiliary boiler to supply the required steam only for ensuring the safety of the Refinery. The size of storage tanks is dependent on the duration of operation on the back-up fuel. Assuming the natural gas supply is reliable, it is expected that it would be sufficient to provide a 3 day storage capacity for each type of oil. The HFO and diesel oil tanks shall be sized for 3 days storage. Figure 2 shows the working principle of a typical CPP.
Figure 2. Example Process Flow Chart of Cogeneration Plant

The air taken from the atmosphere is passed through a filter system and enters into the compressor part of the gas turbine, compressed here and then transmitted to the combustion chamber. The fuel sprayed to the combustion chamber mixes with the compressed air and burns.

The high-pressure gas produced by combustion, which is at a temperature above 1000 – 1100 °C, passes through the blades of the turbine and rotates it and thus, electric power is generated by the generator connected to the turbine. The waste gas at the temperature of 500 – 600 °C exiting from the gas turbine is transmitted through an exhaust pipe to the Heat Recovery Steam Generator (HRSG). The exhaust gas entering into the HRSG cools and then is released to the atmosphere through the boiler flue.

In general, there are three different heat exchanger parts in a HRSG. In Rankine cycle, water first enters into economizer and is heated up to a temperature slightly below the saturation temperature, then is vaporized in the evaporator and this saturated steam is given as superheated steam into the steam turbine after being re-heated in superheater. This is a Rankine cycle for a single-stage pressure group of boiler-steam turbine. However, steam-boiler turbine groups are located in the boiler separately for the three-stage pressure level superheated or non-superheated. Rankine cycle forms different cycles in itself depending upon these stages of pressure. The steam, produced in the HRSG and then entered into the steam turbine, expands at the stages of turbine. Thus, thermal energy transforms into mechanical energy. With the turbine driven, electric power is generated by the generator connected to the turbine.

The low temperature and pressure steam exiting from the steam turbine reaches to the condenser and is transformed into water by being condensed by cooling system. Then, it
is sent, through the condensate pumps, to the feed water tank for the removal of non-condensed gas content in it. Water is re-sent from the feed water tank to HRSG through feed water pumps. This way, it circulates between the Rankine closed-cycle boiler, steam turbine and condenser. The main technical specifications of Kirikkale CPP are given in Table 1.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Power</td>
<td>MWe / MWt</td>
<td>233.7 / 404</td>
</tr>
<tr>
<td>Installed Power of Gas Turbine</td>
<td>MWe</td>
<td>77.1</td>
</tr>
<tr>
<td>Installed Power of Steam Turbine</td>
<td>MWe</td>
<td>79.5</td>
</tr>
<tr>
<td>Net Efficiency (minimum)</td>
<td>%</td>
<td>52</td>
</tr>
<tr>
<td>Gas Turbine</td>
<td>Pcs</td>
<td>2</td>
</tr>
<tr>
<td>Heat Recovery Steam Generator</td>
<td>Pcs</td>
<td>2</td>
</tr>
<tr>
<td>Steam Turbine</td>
<td>Pcs</td>
<td>1</td>
</tr>
<tr>
<td>Approximate Height of Flue</td>
<td>M</td>
<td>50</td>
</tr>
<tr>
<td>Anticipated Electricity Generation Amount</td>
<td>kWh/year</td>
<td>2,030,000,000</td>
</tr>
<tr>
<td>Fuel Type</td>
<td></td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Fuel Requirement</td>
<td>m³/year</td>
<td>300,000,000</td>
</tr>
</tbody>
</table>

Some of the units planned to be established within the scope of Kirikkale CPP are listed below:

- Steam Turbine Building
- Main Transformer
- Auxiliary Transformer
- Electrical Building
- Cooling Towers
- Oil / Gas Module
- Closed Cooling Water Pumps and Heat Exchangers
- Inside Parking Lot
- Workshop and Store Building
- Control / Administration Building
- HRSG
- Stack
- Gas Turbine
- Auxiliary Boilers
- Deareator Feed water Tank
- CEMS
- Demineralized Water Tank
- Heavy Fuel Oil Tank
- Diesel Oil Tank
- Circulating Water Pumps House

3.2 Need for the Project

Fundamental goal of Turkey's energy policy is to decrease the country's external dependence by making efficient, effective, safe and environmentally-conscious use of energy and natural resources, and contributing to prosperity of the country. Within this context, these are the fundamental elements of Turkey's energy policy:

- Decreasing external dependence in energy,
• Providing diversity of source, route and technology,
• Maximum use of renewable energy sources,
• Minimizing the effects on the environment,
• Increasing our country's regional and global activity with regard to energy sector,
• Increasing energy efficiency,
• Making energy accessible by the consumers with regard to cost, time and amount,
• Mobilizing the potentials of public and private sector with competitive market conditions².

Tüpraş is the largest and leading industrial organization with its refining capacity of 28.1 million tons/year. Kirikkale Cogeneration Power Plant having an installed power of 233.7 MWe will both serve to the Tüpraş which has a significant place in the national economy and contribute to the resource diversity in Turkish energy market thus playing an important role in solving the problem of energy deficit and ensuring the security of supply. Accordingly, the Project has a considerable importance for the country.

No Action (Zero Option)

No action option is essential to understand whether the project is actually needed or not. In addition, it gives the opportunity to compare with the other options. However, non-realization of the Project does not meet the steam and energy requirement of the Tüpraş Refinery and the growing energy demand of Turkey.

The existing Thermal Power Plant (TPP) in Kirikkale Refinery is constructed in 1986. TPP unit has been equipped with two 12MWe CTR12 type steam turbines and 21 MWe Nuovo Pignone type steam turbine to supply Refinery’s electric demand. First and second turbine has been built in 1986, third one (21MW) has been built in 2007. There are four 120 t/h boilers in Kirikkale Refinery burning Refinery Gas and Fuel Oil mixture.

The existing Plant located in Tüpraş refinery has adverse effects from environmental and economic aspects. Energy efficiency of the current plant is lower than the planned CCGT system’s efficiency. According to modeling studies, the Project’s emissions (NOₓ and CO) are extremely lower than the limit values set forth by Turkish regulations. Natural gas is used as the main fuel source which is environmentally friendly as compared with other fuel types. Since the selected system will have back-up fuel; the Project guarantees the continuity of energy supply to the Refinery in any emergency case, which brings an advantage compared with the existing plant. Therefore, “no action” can’t be considered as a preferable option. CCGT system will use gas turbines of GE 6FA which is a new technology compared with the existing plant (see Figure 3).

² Speech of Minister of Energy and Natural Resources, Taner YILDIZ, presenting 2011 Budget of the Ministry to TBMM (Grand National Assembly of Turkey) General Assembly.
3.3 Project Area

The Power Plant will be constructed adjacent to the Tüpraş refinery. Seymenoba has identified two possible sites. The first site (ALT-1) of approximately 85000 m² at an altitude of 705 m is located adjacent to the South Eastern corner of the Refinery alongside the existing Hacılar substation. The second site (ALT-2) of approximately 114000 m² at an altitude of 730 m is located adjacent to the South Western corner of the Refinery and is adjacent to the existing bulk oil storage tanks. Alternative project areas, different from the ALT-1 and ALT-2, have not been considered, because main function of the Project is to serve Tüpraş Refinery with steam and energy. Other site alternatives shall not be feasible in terms of supplying steam and energy to the Refinery.

Selected Project Area

ALT-1 has been selected regarding conditions described below;

- Wastewater discharge location (Kızılirmak River) is closer as compared with the ALT-2.
- According to “Air Quality Assessment Studies for Alternative Project Sites Report” prepared by DOKAY in May 2012, air quality modeling studies show that NOx emissions are lower at ALT-1 than the emissions at ALT-2 (see Figure 4).
- Altitude is lower in ALT-1, providing increment in efficiency and power output.
- ALT-1 is closer to the interconnection points with the Refinery steam headers.
3.4 System Configuration

3.4.1 Configuration Options

Option 1 - Two (2) GE 6FA GTs in a 2/2/1 Configuration and two (2) Auxiliary Boilers

Option 2 - Three (3) Siemens ST800 GTs in a 3/3/1 Configuration

Option 3 – Three (3) Siemens SGT800 GTS in a 3/3/1 Configuration and two (2) Auxiliary Boilers

Summary of Modeling Results for 3 Options

According to modeling study, a summary of results for three options is given in Table 2:

<table>
<thead>
<tr>
<th></th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Turbine</td>
<td>GE 6FA</td>
<td>SGT800</td>
<td>SGT800</td>
</tr>
<tr>
<td>Configuration</td>
<td>2/2/1 + 2</td>
<td>3/3/1</td>
<td>3/3/1 + 2</td>
</tr>
<tr>
<td>Power Output</td>
<td>MW</td>
<td>193</td>
<td>170</td>
</tr>
<tr>
<td>Efficiency</td>
<td>%</td>
<td>45.7</td>
<td>44.8</td>
</tr>
<tr>
<td>Capital Cost</td>
<td>US $M</td>
<td>223.077</td>
<td>261.963</td>
</tr>
<tr>
<td>Cost per MW</td>
<td>US $M / MW</td>
<td>1.16</td>
<td>1.54</td>
</tr>
</tbody>
</table>
3.4.2 Selected Plant Configuration

The Plant configuration selection was carried out considering parameters such as efficiency, capital cost, flexibility, total power output and cost per MW. From the comparison described above, Option 1 (2/2/1 + 2) has been selected for the most feasible configuration of all. The new and clean power output of the modeled GE 6FA gas turbine is approximately 70 MWe, allowing significant headroom for degradation to meet the maximum Refinery demand of 38 MWe.

Gas Turbine

The configuration of the gas turbine (GE MS 111 FA) is a single shaft, bolted rotor with the generator connected to the gas turbine through a speed reduction gear at the compressor or “cold” end. A reverse flow, six chamber second generation Dry Low NOx combustion system is standard with six fuel nozzles per chamber. Two retractable spark plugs and four flame detectors are a standard part of the combustion system.

It is recommended to transfer the Gas fuel to Liquid fuel 5 minutes / month with mixture of 50% gas and 50% liquid fuel for gas turbines.

Heat Recovery Steam Generators (HRSGs)

The HRSG shall be designed to accept the full gas flow from the GT exhaust and including any additional gas flow arising from the supplementary firing system.

The GTs will be fired primarily on natural gas therefore the HRSG design shall be optimized for gas fired conditions.

The supplementary firing system shall use natural gas as the primary fuel with the ability to fire using diesel oil as a back-up and shall preferably incorporate grid type design technology. The supplementary firing system will be designed for a maximum firing temperature of 800 °C.

Steam Turbines and Auxiliaries

For the Kırıkkale CPP, the Steam Turbine (ST) output is 79.5 MWe at ISO conditions. The final output will depend on optimizing Power Plant efficiency against steam turbine output.

The ST shall be sized for full condensing mode to maximize power output when the Refinery is shutdown (i.e. it will accept the maximum amount of steam produced by the HRSG when the extractions to the Refinery are closed).

Steam Boilers and FGD System

Two (2) Steam Boilers will be installed to supply the maximum steam required for the Refinery, even if no Gas Turbine are running. Boilers allow steam production up to 109 t/h and steam temperature 370 °C. Fuel gas consumption of Boilers is estimated to be 6900 kg/h (at 100% MCR) where HFO consumption shall be 8400 kg/h (at 100% MCR). Possible operation period of Steam Boilers with HFO is estimated to be 5 minutes/month.

The exhaust system of the Steam Boilers (two (2) boilers each having 95 MWt power) will have two (2) independent stacks (equipped with continuous emission monitoring system...
for NO\textsubscript{x}, dust and SO\textsubscript{x}) for the Steam boilers. Therefore exhaust system will consist of two (2) independent FGD in order to comply with emission when operating with Heavy Fuel Oil (HFO).

The FGD system is designed as a dry FGD with sodium bicarbonate injection. The reaction of the reagent will be finalized in the fabric filters where the solid residue will be accumulated prior to be deposited in waste silo. According to chemical reaction of reagent, estimated solid waste production will be 600 kg/h for the maximum steam production. Figure 5 illustrates the auxiliary boilers and following FGD system.

The concentration of dust in the flue gas leaving the FGD absorber is cleaned by the low pressure pulse jet filter to a dust content of below 20 mg/Nm\textsuperscript{3}, dry (at 6% O\textsubscript{2}).

**Figure 5. Auxiliary Boilers and FGD System**

**Back-up Fuel**

Composition of Diesel Fuel Oil and Heavy Fuel Oil are explained in the following tables:

**Table 3. Expected Diesel Fuel Oil Composition**

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polycyclic aromatic hydrocarbons</td>
<td>% weight</td>
<td>11</td>
</tr>
<tr>
<td>Sulfur</td>
<td>mg/kg</td>
<td>10</td>
</tr>
<tr>
<td>Carbon Residue (From 10% distillation residue)</td>
<td>% weight</td>
<td>0.30</td>
</tr>
<tr>
<td>Ash</td>
<td>% weight</td>
<td>0.01</td>
</tr>
<tr>
<td>Water</td>
<td>mg/kg</td>
<td>200</td>
</tr>
<tr>
<td>Total contamination</td>
<td>mg/kg</td>
<td>24</td>
</tr>
</tbody>
</table>

**Table 4. Expected Heavy Fuel Oil Composition**

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash</td>
<td>% weight</td>
<td>0.10</td>
</tr>
<tr>
<td>Water</td>
<td>% volume</td>
<td>0.5</td>
</tr>
<tr>
<td>Total Residue</td>
<td>% weight</td>
<td>0.15</td>
</tr>
<tr>
<td>Sulfur</td>
<td>% weight</td>
<td>1.5</td>
</tr>
</tbody>
</table>
3.4.3 Option 4 (Enhancement of the Selected Configuration)

This Option is considered to be the removal of one (1) Steam Boiler and therefore increase the Fresh Air Firing (FAF) capacity of HRSGs to 181 t/h. As a part of this enhancement option, back-up fuel for Steam Boiler will be changed from Heavy Fuel Oil (HFO) to Diesel Fuel Oil (DFO) in order to reduce the treatment process required for Steam Boiler Flue gas. The DFO composition and particularly the sulphur content do not require installing a FGD system. Consequently; design, operation and maintenance of the system will be significantly simplified which excludes reagent usage for FGD (800kg/h), solid waste discharge from FGD (600 kg/h), and electric power consumption of FGD unit (approximately 200 kW).

3.4.4 Cooling Water Options

Two cooling options were decided during the cooling technology selection process. Wet cooling towers and air-cooled condensers (ACC) were taken into consideration during this process. The use of an ACC would reduce the performance of the plant resulting from the higher steam turbine exhaust pressure associated with this technology. The capital cost is also likely to increase due to the larger heat transfer surface area required.

Selected Cooling System

During the cooling system selection, environmental and economic cons/pros have been considered. Cooling tower has been found the most appropriate option for the Project. Factors affecting the system selection are:

- Cooling tower O&M cost is lower than the ACC (dry cooling).
- Efficiency loss is lower in wet cooling system compared with the dry cooling.
- Dry cooling system may have noise impact on near sensitive receptors because of usage of fans.
- Dry cooling is dependent on ambient air conditions (during hot seasons system’s efficiency decreases).

Since Tüpraş refinery funded the construction of Kapulukaya Dam, Refinery has the right to use the 6% of the raw water supplied from Kapulukaya Dam. Seymenoba has made a protocol with Tüpraş to use the raw water. Therefore, water supply for the wet cooling system shall not create concern about water supply to the system.

According to comparison of two options, wet cooling has been selected. Disadvantage of wet cooling is the water consumption.

The cooling tower requires a purge flow to be continuously extracted in order to limit and control the dissolved salt of the water stored in the cooling tower basin. The purge flow is calculated in order to maintain a correct level of dissolved salt to inhibit corrosion in the metal parts of cooling water system and inhibit salts precipitation in the cooling water system. The flow fed to the cooling tower will depend on the plant’s operational mode (heat rejection in condenser) and the ambient conditions.
4. EXISTING ENVIRONMENTAL CHARACTERISTICS OF THE PROJECT AREA AND IMPACT AREA

4.1 Flora and Fauna

The Project site and the impact area are under the continental climatic conditions. Therefore, dominant habitat of vegetation is steppe.

Plant, amphibian, reptile, bird and mammal species encountered and likely to be encountered due to the habitat characteristics at the project site and its area of influence are identified during the National EIA studies, and included to the National EIA Report.

4.2 Geological, Hydrogeological and Hydrological Characteristics

The geology of the Project Site is formed by the units belong to Kizilirmak Formation. The formation consists of non-bonded slope wash, sandstone, mudstone and lenses having intermediate layers of gypsum in parts. In addition, it contains tuff and limestone layers in some parts. The formation is generally red in color since the color of the mud is red.

The surface water of Kızılırmak River, which is the surface water source closest to the Project Site, is used limitedly in irrigating farming and power generation. Having been operationalized as a power plant by State Hydraulic Works in 1989, Kapulukaya Dam is used in power generation and also meets the drinking and service water requirement of Kirikkale Province.

4.3 Meteorological and Climatic Characteristics

Kirikkale is dominated by Central Anatolian Continental Climate, which is a sub-type of Continental Climate. In the Central Anatolian Region, summers are slightly hot and winters are cold and the severity of the cold increases towards the eastern parts of the Central Anatolian. Natural vegetation is steppes in the lowlands and dry forests on the uplands due to the summer aridness3.

According to data gathered from Kirikkale Meteorological Station, maximum temperature is 41.6 °C (July 2000), and the minimum temperature is -22.4 °C (January 1980) recorded between the years 1970 and 2011.

4.4 Natural and Archaeological Heritage

Natural and archaeological heritages are not available within the Project Area.

4.5 Expropriation&Easement

There is no area to be expropriated within the scope of the Project. The plant will be constructed within the area owned by Tüpraş refinery. Between the CPP and Hacılار substation, expropriation shall not be required for transmission line of 154 kV (CPP and Substation are adjacent) to the Hacılar substation. Transmission line to the Refinery shall get through the area owned by Tüpraş.

The most suitable route for the discharge water (including cooling water) pipeline is the parallel line to the discharge pipeline of Tüpraş refinery.

There is a branch station of BOTAŞ PRMS at the South border of Tüpraş refinery which is the favorable the natural gas pipeline route. Since the branch station is located within the Refinery area, natural gas pipeline does not require easement & expropriation.

4.6 Landscaping

After the construction period, landscaping will be carried out around the area with the species suitable for the climate and vegetation of the region in which the power plant will be located.

4.7 Land Use

Based on the field survey carried out at the Project Site and its surroundings, the Project Area is categorized as dry agricultural land.

4.8 Population Characteristics of the Region

According to Turkish Statistical Institute (TÜİK) results of 2012, total population of the province is 274,727 whereas the total population of Turkey is 75,627,384 and population density of the province is 61 and population density of the country is 98. As a result this number is below the average for Turkey.

4.9 Seismic Activity

At the Project Site, the return period for any two earthquakes having the magnitudes of 5.0 and 6.0 is 7 years and 43 years, respectively. Besides, while the probability of occurrence of an earthquake having the magnitudes of 6.0 is 20.6%, the probability of occurrence of an earthquake having the magnitudes of 6.0 within a period of 50 years which can be thought as a standard lifecycle has been calculated as 68.5%.

4.10 Soil Characteristics of the Region

The soil in Kırıkkale province generally consists of brown soils. The soil which is brown or grayish on the surface is small-grained and easily dispersible. It has a rich content of lime. Its main rock is of volcanic. These soils are accumulated in the alveolar parts in the highly rugged areas. Exposed volcanic rock surfaces are observed on them. They are fertile since they are rich in minerals. In addition, there are alluvial soils in the riverside on the south. They form thick covers in patches. Their slope is slight. They are suitable for field agriculture and irrigated farming. The fact that the regions dry and receives scarce precipitation is an important factor affecting the soil formation. Kırıkkale has an agricultural area of 306,506 ha. 223,040 hectares of which is irrigable. In a 27,907 hectare part of it (9.1%), irrigational agriculture is done.

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5. ENVIRONMENTAL & SOCIAL IMPACTS OF THE PROJECT AND MITIGATION MEASURES

5.1 Use of Natural Resources

In this section, usage of natural resources such as water (for cooling and construction/operation activities), fuel, and land within the Project will be discussed.

5.1.1 Land Use

The Project Site of approximately 85000 m², at an altitude of 705 m, is located adjacent to the South Eastern corner of the Refinery alongside the existing Hacılar substation. There is no forest land and Protected Area within the Project Site.

The Project Site is within the Tüpraş Refinery boundary, therefore there is no agricultural activity within the Project Site.

5.1.2 Fuel Use

The main fuel for the operation of the Project is natural gas. Estimated consumption of the natural gas is 300,000,000 m³/year.

When natural gas is cut-off or an extraordinary occurrence breaks out and natural gas is not supplied, diesel oil will be used to meet the requirements in the gas turbine with the aim of providing electric and steam safety of Tüpraş. In spite of these measures; if any problem occurs, heavy fuel oil will be utilized in the auxiliary boiler and the limited amount of steam will be produced for the procurement of steam required for the safety of Refinery.

Diesel fuel will be used as fuel for the construction equipment and machinery.

5.1.3 Water Use

It has been foreseen that approximately 550 personnel will work in the construction stage of the project. Based on the assumption in which per capita water consumption will be 185 L/day-per capita, water need of the personnel will be 101,75 m³/day-per capita. The need of drinking water will be met by bottles.

It is assumed that approximately 35 personnel will be employed for the operation stage and per capita water consumption is 185 L/day, the amount of domestic water which is required within the scope of the project will be approximately 6,475 m³/day including hand washing, showers, emergency response cleaning showers, toilets, kitchen and general cleaning works. The drinking water requirement will be met by the bottles, as in the construction stage. The reserve water which will be utilized in the cooling system will be provided from Kapulukaya Dam. Pure (demineralized) water to be stored in the pure water tank will be primarily used for boiler feed water, chemical solution preparation and chemical washing.

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5 http://tuikapp.tuik.gov.tr/Bolgesel/tabloOlustur.doc
6 http://tuikapp.tuik.gov.tr/Bolgesel/tabloOlustur.doc
5.2 Environmental Impacts and Mitigation Measures

In this section, the impacts of the project on physical and biologic environment are defined and legal, administrative and technical measures which will be taken to improve, minimize and prevent these impacts are separately and elaborately explained.

5.2.1 Wastewater

During the construction, the wastewater will be collected within wastewater tank via suitable waster system and treated by package treatment system in accordance with the Water Pollution Control Regulation. The wastewater will be used to prevent the dust which may occur during the construction activities. The expected amount of wastewater during the construction stage has been estimated to be 101.75 m$^3$/day. Since the treated water is used for dust control during construction activities, there will be no discharge of wastewater during the construction period.

Wastewater management during the operation period will be the industrial wastewater treatment plant for the wastewater produced from;

- Process Water: HRSG blow down water, HRSG drainage water, chemical drainage water and other operational wastewater.
- The blow down water of the cooling tower for the free chlorine control.
- Wastewater including oil which is filtered from oil separator.
- Wastewater generated from reverse osmosis system to be used in the cooling water process.

During the operation stage of the Project, expected amount of wastewater will be 2400 m$^3$/day (0.0278 m$^3$/s). According to Kızılırmak monitoring station report of State Hydraulic Works, annual average flow rate of Kızılırmak River is 74.99 m$^3$/s. On the other hand, wastewater discharge to the river is 0.0278 m$^3$/s as mentioned above. According to IFC’s Guideline on Environmental Wastewater and Ambient Water Quality, discharged cooling water shall not result in a temperature increase of no more than 3°C at the edge of the zone where initial mixing and dilution take place. Water balance calculations show that flow rate of the discharge water is insignificant as compared with the flow rate of the river. Therefore, temperature of the discharge water will not affect the actual temperature of the Kızılırmak River. Wastewater discharge point to the river shall be adjacent to the Tüpraş Refinery’s wastewater discharge point.

Wastewater used for the cooling system will be discharged to Kızılırmak River. Seymenoba commits that the effluent, originating from the neutralization treatment plant together with cooling tower blow-down, will comply with the following national limits:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Composite Sampling 24-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD</td>
<td>mg/L</td>
<td>30</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/L</td>
<td>100</td>
</tr>
<tr>
<td>Parameter</td>
<td>Unit</td>
<td>Composite Sampling 24-hours</td>
</tr>
<tr>
<td>------------------</td>
<td>------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>mg/L</td>
<td>10</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>mg/L</td>
<td>-</td>
</tr>
<tr>
<td>Total Cyanide</td>
<td>mg/L</td>
<td>0.5</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>35</td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td>6-9</td>
</tr>
</tbody>
</table>

All effluent will be treated before being combined and discharged to the Kızılırmak River. Buried pipe and outfall will be installed to control the discharge to the existing Refinery discharge route. Cooling tower blow down will be bisulphate dosed before discharge. Effluent, which is contaminated with oil, will be delivered to an oil/water separator. Moreover, the effluents will be treated to comply with the discharge limits.

5.2.2 Flora/Fauna

During the operation period of the Project, anthropogenic factors have been expected to have impact on fauna and flora, therefore on the biological diversity. For this reason; people who are temporarily or permanently stay within the Project Area will be ensured to keep the negative impacts on the flora and fauna at the minimum level. The gathering plant species, the damage on wild animal species, hunting or killing those animals will be definitely prevented.

The wastewater will be handled and treated in a suitable way according to discharge limit values described above.

Moreover; Bern agreement protection measures in regard to the fauna species listed in Bern Agreement Annex-2 and Annex-3 as well as 6th and 7th articles of the agreement will be followed in the operation stage of the project.

5.2.3 Noise

The noise to be generated during the operation stage will be resulted from the gas turbines, steam turbines and air-cooled condensers. The noise, reaching to nearest receptors, will be minimized by the selection of suitable equipment, noise absorbers and isolation.

5.2.4 Solid Waste

The construction waste will be composed of plates, metal parts, packages and boxes, iron, steel, cement packages, wood residual and scrap metals. The storage areas which are assigned for collecting construction waste within short-term will be present in the field. The construction waste which is recyclable will be recycled and non-recyclable construction waste will be disposed in accordance with the related regulation.

Recyclable solid waste (glass, paper, plastic, etc.) which will be generated by the personnel during the construction activities will be collected within separate containers and given to the licensed recycling companies in accordance with the provisions of
“Regulation on Control of Package Waste”. On the other hand, non-recyclable waste will be collected within separate containers and disposed in accordance with the provisions of “Regulation on Control of Solid Waste”.

The amount of excavation soil which will be obtained as a result of excavation to be performed in the construction stage within the scope of the project has been expected to be approximately 35,000 m$^3$. The excavation material will be primarily used as filling material for the plants to be built as well as rehabilitation of the current roads and environmental planning. Unused part of the excavation waste will be disposed in the excavation storage area determined by the related municipality in accordance with the provisions of “Regulation on Control of Excavation Soil, Construction and Debris Waste”.

As the construction activities progress, it has been expected that waste which may be specified as hazardous waste such as painting boxes, diluting containers, etc. will be generated. These wastes will be temporarily stored in the waterproof concrete area separate from other wastes and sent to the plant with waste disposal license for the final disposal. During the storage and transportation stages; these materials will be disposed in accordance with the provisions of “Regulation on Control of Hazardous Waste”. Estimated amount of waste from FGD system will be 600 kg/h for the maximum steam production. Sodium sulphite (Na$_2$SO$_3$) and sodium sulphate (Na$_2$SO$_4$) (product for the reaction of reagent sodium bicarbonate with SO$_2$-SO$_3$), produced from FGD system, will be managed in the same way described above.

Packaging waste will be generated by the personnel working during the site preparation, construction, and operation stages of the Project. Recyclable solid waste such as package material and similar waste which will be generated from the construction works will be recycled; having signed the protocol with Hacılar Municipality; non-recyclable waste given to the solid waste collection system will be disposed. Packaging waste such as paper, cardboards, etc. which may be recycled will be collected in the containers whose tops are covered within the construction site separate from the domestic solid waste and then sent to the licensed recycling companies.

If tyres of vehicles and construction vehicles are required to be changed in the Project Site, the tydes changes will be delivered to the licensed carriers in accordance with the provisions of “Regulation on Control of Tyres Which Have Completed Their Life-Cycles”.

5.2.5 Emission

The manner in which the pollutants will be released to the atmosphere from the flue of the proposed plant will spread within the specified construction area (17.5 km in north- south direction, 17.5 km in east – west direction) under the current meteorological conditions and the possible ground level concentration (YSK) values generated by the pollutants in question have been examined with the Air Quality Modeling Study conducted in September 2012. The modeling study has been conducted including existing thermal power plant operation and planned CCGT’s normal operational phase.

Generally, the source of SO$_2$ emissions in the gas flue is the oxidation of the sulphur within the fuel. The emission control is performed by either decreasing the sulphur content
of the fuel or increasing SO₂ gas. Since natural has including the sulphur in the negligible level will be used as main fuel in Kirikkale Cogeneration Power Plant, SO₂ emissions generated from the plant will be in the negligible level. Since diesel fuel will be used as reserved fuel, it has been expected that SO₂ will be generated under the working conditions in which diesel fuel is used.

There are two factors causing NOₓ emissions which will be generated as a result of combustion process to be performed in the plant. The first one is nitrogen content of the fuel used for the combustion process. However; more importantly, NOₓ emission is generated from the high-temperature oxidation of the nitrogen free in the air. The generation of NOₓ is easier when the combustion temperature increases. The boiler combustion, combustion temperature, pressure etc. are the factors determining the emissions in question within the plant to be built. The low-NOₓ burner will be used to control NOₓ emissions generated from the planned power plant. NOₓ will be increased by decreasing the air rate within specific areas as possible as and fixing the deficient fire.

CO emissions are generated as a result of inefficient combustion. The suitable persistency period and high-temperature should be ensured to complete the controlled combustion. The limit value of CO emission is % 15 O₂ and 100 mg/Nm³ in the volume. CO emission to be generated from the flue of the plant will be maximum 100 mg/Nm³.

Estimated mass flow rates of pollutants running on natural gas and diesel oil are tabulated below:

**Table 6. Mass Flow Rates and Concentrations of Pollutants for Natural Gas Conditions**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOₓ</td>
<td>33 mg/Nm³ (dry, %15 O₂)</td>
</tr>
<tr>
<td></td>
<td>18.12 kg/h (as NO₂)</td>
</tr>
<tr>
<td>CO</td>
<td>62 mg/Nm³ (dry, %15 O₂)</td>
</tr>
<tr>
<td></td>
<td>34.04 kg/h</td>
</tr>
</tbody>
</table>

**Table 7. Mass Flow Rates and Concentrations of Pollutants for Diesel Oil Conditions**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Gas Turbine</th>
<th>Auxiliary Boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOₓ</td>
<td>33 mg/Nm³ (dry, %15 O₂)</td>
<td>150 mg/Nm³ (dry, %15 O₂)</td>
</tr>
<tr>
<td></td>
<td>18.12 kg/h (as NO₂)</td>
<td>30 kg/h (as NO₂)</td>
</tr>
<tr>
<td>CO</td>
<td>62 mg/Nm³ (dry, %15 O₂)</td>
<td>80 mg/Nm³ (dry, %15 O₂)</td>
</tr>
<tr>
<td></td>
<td>34.4 kg/h</td>
<td>16 kg/h</td>
</tr>
<tr>
<td>SO₂</td>
<td>100 mg/Nm³ (dry, %15 O₂)</td>
<td>200 mg/Nm³ (dry, %15 O₂)</td>
</tr>
<tr>
<td></td>
<td>54.91 kg/h</td>
<td>40 kg/h</td>
</tr>
</tbody>
</table>

*The values are design values of the Project*
NOₓ exhaust gas emissions will not exceed the following concentrations during steady-state operation from base load down to 70% load over the ambient temperature range from -22.4°C to 41.6°C.

CO₂ exhaust gas emissions will not exceed the following concentrations during steady-state operation at base load down to 70% load over the ambient temperature range from -22.4°C to 41.6°C.

Table 8. GT and HRSG Emission Guarantees*

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Natural Gas</th>
<th>Liquid Fuel (Oil)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IFC</td>
<td>Annex V of IED</td>
</tr>
<tr>
<td>NOₓ (mg/Nm³)</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>SO₂ (mg/Nm³)</td>
<td>N/A</td>
<td>35</td>
</tr>
<tr>
<td>CO (mg/Nm³)</td>
<td>N/A</td>
<td>100</td>
</tr>
</tbody>
</table>

* Guaranteed values are for 15% O₂, 0°C, 101.325 kPa dry flue gases
** For the absence of GTs

Each steam boiler will not exceed the following concentrations during steady-state operation from base load down to 50% load over the ambient temperature range from -22.4°C to 41.6 °C. Since stacks of steam boilers (each 95 MWt) are independent from each other, threshold levels are for the plants below 100 MWt.

Table 9. Steam Boilers Emission Guarantees*

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Natural Gas</th>
<th>Liquid Fuel (Oil)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IFC</td>
<td>Annex V of IED</td>
</tr>
<tr>
<td>NOₓ (mg/Nm³)</td>
<td>240</td>
<td>100</td>
</tr>
<tr>
<td>SO₂ (mg/Nm³)</td>
<td>N/A</td>
<td>35</td>
</tr>
<tr>
<td>CO (mg/Nm³)</td>
<td>N/A</td>
<td>100</td>
</tr>
</tbody>
</table>

* Guaranteed values are for 3% O₂, 0°C, 101.325 kPa dry flue gases

Each stack of the Plant will have Continuous Emissions Monitoring System (CEMS). CEMS will be monitored online; system will be connected to the Ministry of Environment and Urbanization’s Virtual Private Network (VPN). Annual validity report will be prepared as the requirement of Turkish Continuous Emissions Monitoring System Notice.

5.2.6 Transmission line and Pipelines

Wastewater discharge pipeline

Appropriate disposal routes for the various aqueous discharges from the Plant are not yet to be finalized. It is thought that all types of wastewater (after the appropriate treatment processes) shall be discharged to the Kızılırmak River. Possible impact of the wastewater discharge to the Kızılırmak River is the thermal pollution. Since the flow rate of the
wastewater is much lower than the flow rate of the river, cooling water discharge shall not cause thermal pollution in the river. Therefore, aquatic ecosystem will not be affected.

Transmission line

Since the TEİAŞ substation (Hacılar Substation) is adjacent to the Power Plant, transmission line to the connection point will not go through any private parcels. Hence, there won’t be negative impact on the environment.

Natural gas supply line

Natural gas will be supplied from the BOTAŞ PRMS station, which is to be constructed about 1200 meters away from the Project Site, or the branch of the station which is located at South border of Tüpraş Refinery. Since the branch of the PRMS is within the borders of the Refinery, this option shall not cause environmental and social negative impact.

5.3 Social Impacts and Mitigation Measures

The income growth will come into the question during the construction and operation stages of the project. The commercial services (accommodation, food and clothing consumption, etc.) that the employees will provide from the neighborhood will contribute to the local economy. Since the planned plant will create employment for the personnel, the income level of the region will increase. When the economic benefits in the construction and operation stages are compared; the economic input will be greater in the construction stage.

When the economic benefits in the construction (550 employees) and operation stages (35 employees) are compared; the economic input will be greater in the construction stage. The expenses incurred by the daily needs of the personnel will have great contributions to the local economy.

An infirmary (first-aid center) will be constructed in the construction stage of the project. The infirmary will be constructed for injuries and diseases which may occur in the operation stage of the project within the campus borders of TUPRAS. The other healthcare requirements of the personnel will be covered by other healthcare institutions within the region.

When the economic and social impacts created by the proposed project are taken into the consideration, it is understood that the plant will have positive impacts. Natural and archaeological heritages are not available within the Project Site. Therefore; it has been expected that the project will not have any negative impacts on these properties.

The major environmental impact of the project is that it will make contributions to local and national economy when the project is realized. The cogeneration power plant projects clearly generate energy when compared to the energy generation types of other power plants. Moreover; it is beneficial project due to the energy supply without transfer loss and creating local employment in the construction and operation stages.
5.3.1 Economics
The requirements generally resulted from the large-scale projects may increase the current social service and infrastructure load within the region. There will be potential short employment opportunities for local labor during construction. Additionally, local supply of goods and services (construction materials, food, medicine, accommodation, catering, transportation etc.) associated with Project activities will contribute to the local economy as well.

5.3.2 Education Services
When the project is realized; people will come to the region from the local neighborhood, provinces and villages to work in Kırıkkale Cogeneration Power Plant and new branches. Since the Project Site is close to the city center, it is possible that the personnel working within the project will easily derive benefit from the education opportunities within the region. Therefore; the education infrastructure within the city will not be negatively affected by the possible population growth.

5.3.3 Healthcare Services
The infirmaries will be constructed for injuries and diseases which may occur in the operation stage of the project within the campus borders of TUPRAS. If serious accidents are experienced, it has been expected to use healthcare centers within Kırıkkale province and its counties. Therefore; it is possible that the capacity of the hospitals and healthcare centers within the region will increase when the project is constructed and put into the operation. However; since the healthcare centers out of the power plant will not be visited for minor injuries, a dramatic increase on the local healthcare services is not expected. Being followed the rules for plant safety and labor health in each stage; the possible impacts will be kept in the minimum level.

5.3.4 Workers Accommodation
During the construction phase, construction workers who live in city of Kırıkkale and named local personnel will live in their own house or apartment. Qualified workers and 35 operational personnel will be provided a hostel by Project Contractor in city of Kırıkkale or Hacilar District.
## 5.4 Environmental / Social Management and Monitoring

<table>
<thead>
<tr>
<th>No</th>
<th>Issue / Action</th>
<th>Environmental Risks Liability/Benefits</th>
<th>Legislative Requirement / EBRD Performance Requirement / Best Practice</th>
<th>Investment Needs / Resources /Responsibility</th>
<th>Timetable / Project Phase</th>
<th>Target and Evaluation Criteria For Successful Implementation</th>
<th>Findings and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Environment, Health, Safety and Social (EHSS) Management and Training</td>
<td>Demonstration for the general public of the Company’s objectives and basic activities aimed at compliance with the EHSS requirements during the construction of the Kirikkale CPP Project and the full scale CPP operation</td>
<td>EBRD PR 1, Voluntary and Best Practice</td>
<td>Project Budget / Contractor</td>
<td>During the construction period</td>
<td>Annual EHSS Performance Reports. Reports should also be submitted to the EBRD</td>
<td>Provide link to company web site and KPI’s in annual report</td>
</tr>
<tr>
<td>1.1</td>
<td>Adopt and publicly disclose overarching Environmental, Health, Safety, and Social Policy (EHSS Policy). As part of Policy and SEP develop a Project web sites, with general EHS information and Key performance Indicators (KPIs)</td>
<td>Provision of trained and qualified human resources</td>
<td>EBRD PR 1, Voluntary and Best Practice</td>
<td>Project Budget / Contractor</td>
<td>During the construction period</td>
<td>Organizational chart in place including EHSS personnel for each operational department. ISO 14001 and OHSAS 18001 certification within 2 years of commissioning the plant</td>
<td>ISO 14001 and OHSAS 18001 certification within 2 years of commissioning the plant</td>
</tr>
<tr>
<td>No</td>
<td>Issue / Action</td>
<td>Environmental Risks Liability/Benefits</td>
<td>Legislative Requirement / EBRD Performance Requirement / Best Practice</td>
<td>Investment Needs/ Resources /Responsibility</td>
<td>Timetable / Project Phase</td>
<td>Target and Evaluation Criteria For Successful Implementation</td>
<td>Findings and Comments</td>
</tr>
<tr>
<td>----</td>
<td>----------------</td>
<td>--------------------------------------</td>
<td>-------------------------------------------------</td>
<td>----------------------------------------</td>
<td>---------------------------</td>
<td>-------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>1.3</td>
<td>Revision of the training program to include EHSS induction and PPE use. Implementation and Monitoring of Trainings</td>
<td>Increased awareness about EHSSMS Protection of worker health and minimization of occupational risks</td>
<td>EBRD PR 1, PR 2 Voluntary and Best Practice The Regulation on Occupational Health and Safety (Official Gazette dated December 09, 2003 and numbered 25311) includes provisions for the supply of PPEs to workers and ensuring the use of the PPEs.</td>
<td>Project Budget / Contractor</td>
<td>2013</td>
<td>Training program in place Up to date training records Summary of trainings as part of the annual EHSS Report</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Appoint a qualified Environmental manager to report directly to site manager, with independent reporting lines to corporate management</td>
<td>Protection of environment health and minimization of environmental impacts associated with constructor’s activities</td>
<td>EBRD PR 1 Best Practice</td>
<td>Project Budget / Contractor</td>
<td>Prior to construction</td>
<td>Designated person throughout construction and operation</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Appoint an independent EHS Consultancy to undertake periodic external monitoring of key EHS issues as outlined in this ESMMP and the ESIA documentation.</td>
<td>To ensure its sustainability in the environmental health and safety</td>
<td>EBRD PR 1 Best Practice</td>
<td>Appoint: prior to first disbursement Monitor: every 6 months during construction and annually for the first 2 years of operations; any additional monitoring requirements to be based on monitoring outcomes.</td>
<td></td>
<td>External EHS monitoring reports</td>
<td></td>
</tr>
</tbody>
</table>

2. Labour and Working Conditions
<table>
<thead>
<tr>
<th>No</th>
<th>Issue / Action</th>
<th>Environmental Risks Liability/Benefits</th>
<th>Legislative Requirement / EBRD Performance Requirement / Best Practice</th>
<th>Investment Needs/ Resources /Responsibility</th>
<th>Timetable / Project Phase</th>
<th>Target and Evaluation Criteria For Successful Implementation</th>
<th>Findings and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Keeping centralized records of accidents and incidents including information on contractor safety performance and fatalities. Information to include dates severity, causes, and corrective actions.</td>
<td>To improve working conditions and develop good working relationships</td>
<td>Turkish Labor Law no: 4857 EBRD PR 2</td>
<td>Project Budget / Contractor</td>
<td>During the construction period</td>
<td>Up to date H&amp;S records Accident and fatality statistics as part of the annual EHSS reports Complaints will be received from the workers.</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Preparation of Instruction Cards and Maintenance Cards to be placed on work equipment</td>
<td>Minimization of occupational risks and work accidents</td>
<td>The Regulation on Occupational Health and Safety (Official Gazette dated December 09, 2003 and numbered 25311) includes provisions for ensuring that workers are appropriately informed about the instructions and procedures for equipment use.</td>
<td>Project Budget / Contractor</td>
<td>During the construction period</td>
<td>Instruction Cards and Maintenance Cards in place</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Develop a formal grievance mechanism for employees and constructors and disseminate information about its uses to the workforce.</td>
<td>To minimize labor rights breaches</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Pollution Prevention and Abatement
<table>
<thead>
<tr>
<th>No</th>
<th>Issue / Action</th>
<th>Environmental Risks Liability/Benefits</th>
<th>Legislative Requirement / EBRD Performance Requirement / Best Practice</th>
<th>Investment Needs/ Resources/Responsibility</th>
<th>Timetable / Project Phase</th>
<th>Target and Evaluation Criteria For Successful Implementation</th>
<th>Findings and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Design and operate the plant in compliance with the EU Industrial Emissions Directive (IED) Annex V and EU BREF Notes for Large Combustion Plants</td>
<td>Ensure project is designed and operated in line with National and EU environmental standards and best available techniques.</td>
<td>EBRD PR 3</td>
<td>Project Budget</td>
<td>Ongoing</td>
<td>BAT Assessment to confirm compliance 1 year from commissioning</td>
<td>Compliance with Turkish law</td>
</tr>
<tr>
<td>3.2</td>
<td>Within 1 year of commissioning the plant undertake a BAT Assessment to verify a.) plant is compliance with Turkish law ad ESAP b.) review options for additional improvements and c.) develop an additional BAT focused action plan to ensure continues BAT compliance.</td>
<td>Need to verify that all environmental requirements have been met, and as part of BAT review and develop an action plan for continued improvement, as appropriate.</td>
<td>EBRD PR 3 Turkish and EU law</td>
<td>1 year from commissioning plant</td>
<td>Project Budget / Independent Consultant</td>
<td>Report results as part of the Annual EHSS Report</td>
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| 3.3 | Dust generation from excavation activities | Avoidance of excessive dust generation affecting human and flora/fauna elements in the vicinity of the site. | EBRD PR 3  
Turkish Regulation on Assessment and Management of Air Quality (Official Gazette dated June 6, 2008 and numbered 26898, amended in Official Gazette dated May 5, 2009 and numbered 27219)  
Best Practice | Project Budget / Contractor | During the construction period | Site Observation  
Construction Monitoring Reports to EBRD  
(Dust Emission measurements if required) | |
| 3.4 | Provide waste water discharge connection and discharge permit for construction vehicles facilities | Waste minimization, Resource conservation and effective waste management. | Turkish Solid Wastes Control Regulation  
Turkish Regulation on General Principles of Waste Management  
Turkish Packaging Waste Control Regulation  
EBRD PR 1, EBRD PR 3 and EBRD PR 4 | Project Budget / Contractor | During the construction period | Site Observation  
Construction Monitoring Reports to EBRD.  
The disposal agreements with the licensed companies for all necessary type of wastes will be signed and the records will be kept on site. (The amount of waste generated, recycled and disposed) | |
| 3.5 | To ensure effective traffic management and minimize health and safety risks for the public. | Entrance to the site will be clear and properly designed.  
Prescribed routes for construction traffic will be agreed with the appropriate authorities, particularly with respect to tanker and truck traffic and special loads (heavy and wide loads). | EBRD PR4  
Best Practice | Project Budget / Contractor | During the construction period | Site Observation  
Construction Monitoring Reports to EBRD | |
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<tr>
<td>3.6</td>
<td>Prepare an inventory of all hazardous wastes and appropriate disposal methods. Prepare and implement a waste management procedure. Provide temporary storage areas for hazardous wastes, constructed in accordance with CPP at all maintenance facilities.</td>
<td>To ensure proper disposal of hazardous wastes which to prevent the risk of soil, surface waters and groundwater contamination.</td>
<td>Turkish Regulation on Control of Waste Oil. Turkish Regulation for Control of the Tires Which Have Completed Their Life-Cycles. Turkish Regulation on Control of Waste Batteries and Accumulators. Turkish Hazardous Waste Control Regulation. Turkish Medical Waste Control Regulation. EBRD PR 3.</td>
<td></td>
<td></td>
<td>Site Observation Construction Monitoring Reports to EBRD. Amount of waste generated and transported (Waste Declaration Form and National Waste Transportation Forms).</td>
<td></td>
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<td>3.7</td>
<td>Provide portable toilets or other means to contain sanitary wastes as needed, at all work locations. Discharges wastes to appropriate treatment as required by authorities.</td>
<td></td>
<td>EBRD PR 3. BAT.</td>
<td></td>
<td></td>
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<td>No unauthorized discharges or release of untreated sanitary wastes. Report to Bank on any accidental releases.</td>
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| 3.8 | Prevention of Soil pollution  
Provide secondary containment for Supply and Maintenance Facility | Protection of environment 
Elimination of fines due to legal incompliance | Article 6 of Regulation on Soil Pollution Control and Point Source Polluted Areas (Official Gazette dated June 08, 2010 and numbered 27605); prevention of the soil pollution at source is the main principle. Therefore, companies producing or storing substances that could cause soil pollution shall take required mitigation measures. All above ground fuel and waste oil storage tanks shall be surrounded with secondary containment. | Project budget / Contractor | During construction | Secondary containment for used oil tank at Supply and Maintenance Facility in place |
| 3.9 | Use dry low NOx combustion system and low NOx burners | To reduce the NOx emission and comply with emission levels as defined in the ESIA disclosure documents and Annex V of the EU Industrial Emissions Directive | EBRD PR 3 BAT | Operation | Emmission monitoring throughout the operation and maintenance (by CEMS) |
| 3.10 | Operation of a wastewater treatment plant and cooling water discharge systems. Ensure compliance with National and BAT requirements and ESIA disclosure conditions. Install monitoring for wastewater / cooling water discharge points | Meet wastewater discharge limit values 
Preventing the pollution of the receiving environment 
Install a meter and a temperature monitor on the discharge points 
Monitor any thermal pollution in summer to ensure that river quality is not affected | Turkish Water Pollution Control Regulation (Official Gazette dated December 31, 2004 and numbered 25687, amended in Official Gazette dated November 30, 2012 and numbered 28483) 
EBRD PR 3, EBRD PR 6 BAT | Project budget / Contractor | Operation | Analysis of wastewater and cooling water by sampling/monitoring. Provide average monthly data and any abnormal peaks in annual report. |
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<tr>
<th>No</th>
<th>Issue / Action</th>
<th>Environmental Risk / Benefits</th>
<th>Legislative Requirement / EBRD Performance Requirement / Best Practice</th>
<th>Investment Needs / Resources / Responsibility</th>
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<tr>
<td>3.11</td>
<td>Disposal of sludge produced from wastewater treatment plant</td>
<td>Elimination of adverse effects of the wasted sludge</td>
<td>Turkish Hazardous Waste Control Regulation (Official Gazette dated March 14, 2005 and numbered 25755, amended in Official Gazette dated October 30, 2010 and numbered 27744) EBRD PR 3</td>
<td></td>
<td>Operation</td>
<td>Site observation and sludge analysis by sampling</td>
<td></td>
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<td>3.12</td>
<td>Installation of CEMS to monitor NOx and SOx emission from the gas turbines as well as auxiliary boilers</td>
<td>Helps to improve air quality CEMS to be installed on each stack</td>
<td>Turkish Continuous Emission Monitoring Systems Bulletin (Official Gazette dated October 12, 2011 and numbered 28082)</td>
<td></td>
<td>Project budget / Contractor</td>
<td>Install prior to Commissioning Operation</td>
<td>Regulatory online observation Regular calibration</td>
</tr>
<tr>
<td>3.13</td>
<td>Recycling of solid waste</td>
<td>Reduction of use of natural resources</td>
<td>Turkish Solid Wastes Control Regulation (Official Gazette dated March 14, 1991 and numbered 20814, amended in Official Gazette dated March 26, 2010 and numbered 27533) EBRD PR 3</td>
<td></td>
<td>Operation and Construction</td>
<td>Site observation</td>
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<td>3.14</td>
<td>Use low Sulphur fuel whenever possible. When HFO used operated the FGD on the auxiliary boilers, dispose of FGD waste in an approved and BAT compliant way</td>
<td>Ensure ongoing compliance air quality requirements</td>
<td>National legislation and EBRD PR 3</td>
<td></td>
<td>Operation</td>
<td>Provide information in annual report on fuel quality used, when HFO used (and %S) and number of hours of operation with FGD</td>
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**4. Community Health and Safety**
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<tr>
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<th>Issue / Action</th>
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<tr>
<td>4.1</td>
<td>Develop and implement procedures to protect public health and safety.</td>
<td>Ensure effective social management and minimize health and safety risks for the public.</td>
<td>EBRD PR 2 and PR 4 Best Practice</td>
<td>Project budget / Contractor</td>
<td>During construction period</td>
<td>Site observation Complaints will receive during operation</td>
<td></td>
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<td>4.2</td>
<td>Occupational Health and Safety</td>
<td>Minimize the health and safety risks for workers</td>
<td>Turkish Occupational Health and Safety Statute EBRD PR 2</td>
<td>Project budget / Contractor</td>
<td>During construction</td>
<td>Site observation</td>
<td></td>
</tr>
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<td>4.3</td>
<td>Human Resources</td>
<td>Improve working conditions and develop good working relationships</td>
<td>Turkish Labor Law no: 4857, EBRD PR 2</td>
<td>Project budget / Contractor</td>
<td>During construction</td>
<td>Complaints will be received from the workers</td>
<td></td>
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<td>5.1</td>
<td>Implement the Stakeholder Engagement Plan and update every 3 years</td>
<td>Prevention of conflicts with stakeholders, ensure sustainable project</td>
<td>EBRD PR 10</td>
<td>Project budget / Contractor</td>
<td>During construction</td>
<td>Implementation of SEP and reporting of outcomes in the Annual EHSS Report</td>
<td></td>
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<td>6.1</td>
<td>Soil layer removal and storage. Land use minimization and prevention of alien species to the Project Area</td>
<td>Conserving the biodiversity of the Project Area</td>
<td>EBRD PR 6</td>
<td>Project budget / Contractor</td>
<td>During construction</td>
<td>Site observation</td>
<td></td>
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