

Environmental and Social Assessment for Karadağ Wind Power Plant in Turkey



Prepared for:

GARET Enerji Üretim ve Ticaret A.Ş.

Ankara, Turkey

Environmental and Social Assessment for Karadağ Wind Power Plant in Turkey

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List of Acronyms

AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
APCRH	Air Pollution Control Regulation for Heating Sources
AQAMR	Air Quality Assessment and Management Regulation
CHC	Central Hunting Commission
CITES	Convention on the International Trade in Endangered Species of Wild Flora and Fauna
CO	Carbon monoxide
dB(A)	A-Weighted Decibel
DSİ	State Hydraulic Works
E	East
EGECR	Exhaust Gases Emission Control Regulation
EIA	Environmental Impact Assessment
EİE	General Directorate of Electrical Power Resources Survey
EMRA	Energy Market Regulatory Authority
ESA	Environmental and Social Assessment Report
GARET	Garet Enerji Üretim ve Ticaret A.Ş
GDDA	General Directorate of Disaster Affairs
hr	hour
HASP	Health and Safety Plan
HCR	Hazardous Chemicals Regulation
HWCR	Hazardous Wastes Control Regulation
Hz	Hertz
IAPCR	Industrial Air Pollution Control Regulation
IBA	Important Bird Area
ICAO	International Civil Aviation Organization
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
kg	kilogram
km	kilometer
kV	kilovolt
kW	kilowatt
KWPP	Karadağ Wind Power Plant
LC	Least concern
Leq	Equivalent Continuous Noise Level
M	meter
MENR	Ministry of Energy and Natural Resources
mg	milligram
mm	millimeter
MoEF	Ministry of Environment and Forestry
MSDS	Material Safety Data Sheets
MTA	General Directorate of Mineral Research and Exploration
MW	Megawatt

MWCR	Medical Waste Control Regulation
N	North
NE	Not Evaluated
NGCCPP	Natural Gas Combined Cycle Power Plant
NGO	Non-governmental organizations
NO _x	Nitrogen oxides
NSR	Noise Sensitive Receptor
NT	Near threatened
NWCC	National Wind Coordinating Committee
°C	Degree Celsius
PCB	Polychlorinated biphenyl
PDoEF	Provincial Directorate of Environment and Forestry
PDR	Project Description Report
PM	Particulate matter
PWCR	Packaging Waste Control Regulation
RAMEN	Regulation on Assessment and Management of Environmental Noise
RSPB	Society for the Protection of Birds
S	South
sec	second
SO ₂	Sulphur dioxide
SPCR	Soil Pollution Control Regulation
SWCR	Solid Waste Control Regulation
TOC	Total Organic Carbon
TUIK	Turkish Statistical Institute
USEPA	U.S. Environmental Protection Agency
UTM	Universal Transverse Mercator
VOC	Volatile organic carbon
VU	Vulnerable
W	West
WHO	World Health Organization
WOCR	Waste Oil Control Regulation
WPCR	Water Pollution Control Regulation
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

GARET Enerji Üretim ve Ticaret A.Ş. (GARET) proposes to install Karadağ Wind Power Project (KWPP) with 10 MW installed capacity in İzmir Province of Turkey. The KWPP will have 4 turbines, each having an output of 2.5 MW. Power will be connected via a 13 km transmission line to the 154 kV Alosbi Transformer Station. GARET obtained the “Electric Power Generation License” from the Energy Market Regulatory Authority (EMRA) for the proposed Project site. A 49-Year License (License No. EU/1632/6/1194, dated June 5, 2008) is granted for the proposed Project by the opinion of EMRA under the provisions of Law No. 4628 governing the electricity market in the Republic of Turkey. The purpose of this proposed Project is to utilize wind energy potential in Turkey and to compensate energy requirement through a sustainable, environmentally and cost effective way.

The Project will be located near Çakmaklı Village located in Aliağa District of İzmir Province. İzmir Province is located to the west of Turkey in the Aegean Region. An environmental Project Description Report (PDR) was prepared and submitted to İzmir Provincial Directorate of Environment and Forestry (PDoEF). The PDoEF reviewed the PDR for the Project and decided that a detailed EIA report was not required for the Project.

This Environmental and Social Assessment (ESA) report is prepared according to the Equator Principles (EP). The purpose of the ESA is to identify potential environmental and social impacts of the Project on the local environment and community during construction, operation and decommissioning phases. The ESA also aims at providing mitigation measures to eliminate potential adverse impacts and propose a management and monitoring plan. The report is also prepared in accordance with the host country Turkish Legislation and International Finance Corporation (IFC)-Worldbank Group Guidelines. The report includes a comprehensive description of Turkish Environmental Legislation and IFC/WB Guidelines relevant with the proposed Project.

AECOM conducted a detailed environmental baseline study in the scope of the ESA study. General climatology, air quality, land use, noise, geology, flora, fauna, naturally protected areas, archeologically protected areas specific to the Project site were assessed in the scope of this study. When general climatology of the region is assessed, it was observed that the average temperature, wind, precipitation and humidity data recorded in the vicinity of the Project site is in the range of operation parameters of turbines and the Project site is suitable for turbine operation in terms of general climatology. In terms of air quality, the proposed Project site can be regarded to be located in a semi-degraded air-shed. As for land use, the Project site is forestry area and surrounding area is industrial zone. The Project area is registered as state-owned land.

Background noise level monitoring studies were undertaken for two days at the closest noise sensitive receptor. Ambient noise levels were continuously measured for 48 hours and the levels were logged for ten minute sampling interval. Concurrent wind speeds and direction and rainfall data were recorded on a free standing approximately 10 m anemometer mast. Wind speed and direction data and rainfall data were collected over a similar period, and averaged over the same ten minute periods as the noise data to allow analysis of the measured background noise as a function of wind speed. The results of the background noise level measurements are compared with respect to both

IFC/World Bank Group Environmental, Health and Safety Guidelines – Wind Energy (April 30, 2007) and Turkish Regulation on Assessment and Management of Environmental Noise (RAMEN). Results demonstrated that the background noise levels are below the limits set by Turkish RAMEN and daytime IFC/World Bank at most of the measurement time. However, nighttime measurement data exceed the IFC/World Bank limits at most of the time indicating effect of high wind speeds and operating industrial activities in close vicinity of the proposed site.

Geological unit, on which the Project site is located, is Karadağ crest in Karacadoğan cape (which is encompassed by Nemrut gulf and Horozgediği bay) in Çakmaklı district of Aliğa İzmir. The complex geology of the region is due to various geological stages of the Paleotectonic and the Neotectonic. İzmir City and therefore the Project site are located in the 1st Degree Seismic Zone according to the earthquake zones determined by the General Directorate of Disaster Affairs.

Flora inventory is prepared by gathering data from site survey, literature studies and referencing floristic studies of the similar ecological characteristics. Site survey was conducted within the scope of the PDR. As a result of this inventory study, 74 species belonging to 31 families are identified in the Project area and its vicinity. None of the species has conservation status in accordance with the Red Data Book and Bern Convention. In addition no endemic specie is determined according to the official website of Turkish Plants Data Service (TUBIVES).

In order to determine terrestrial fauna species within the Project site and its vicinity data from site survey, literature studies and referencing studies are gathered. A site survey was conducted within the scope of the PDR. As a result of this study, 4 amphibian, 9 reptile species and 12 mammals are identified as most likely to exist in the Project site and its vicinity. None of these species are endemic. According to site survey and literature review 37 bird species have been identified at the Project site. All species prefer to live in terrestrial habitats except two bird species. The Project site is not located on a major migration route.

In accordance with the national environmental legislation, there are no national parks, nature reserves, natural monuments, wildlife protection areas and wildlife improvement areas within the Project site and its close vicinity.

There are no archeological remains within the Project site. However, there exist several archeological sites in close vicinity to the Project site. The closest archaeologically protected sites to the proposed Project sites are Nameless 3rd Degree Archaeologically Protected Site and Nameless 1st Degree Archaeologically Protected Site which are located approximately 0.5 km and 1.2 km to the closest turbine. In addition, Kyme Ancient City is located approximately 3 km to the closest turbine.

The ESA report also provides mitigation measures to eliminate potential adverse impacts and propose a management and monitoring plan. The following topics have studied in the ESA report: noise, air emissions, water supply and wastewater, hazardous wastes, non-hazardous wastes, soil and groundwater, biological resources (including bird collision risk and avian mortality), cultural and historical resources, visual impacts, shadow flicker and blade glint, socio-economic impact. It was estimated that the construction period of the Project will take 12 months and the operation period of the Project will take 49 years.

It is calculated that the noise generated during construction will be temporary and will comply with the noise limits stipulated by Turkish Regulation on Assessment and Management of Environmental Noise (RAMEN). The potential noise impact of the wind turbines on sensitive receptors during operation phase is determined by noise modeling. Commercially available WindPro version 2.6 noise propagation model, which is based on ISO 9613-2, is used in this Project. ETSU-R-97, The Assessment and Rating of Noise from Wind Farms (1996), noise assessment methodology was used in this study. ETSU methodology allows users to account for the affect of wind speed on noise evaluations. The results are compared with Turkish RAMEN and IFC/World Bank noise guidelines. Noise generated by the turbines complies with both Turkish limits and IFC/World Bank guideline values.

AECOM evaluated the air emissions that will be generated during construction. It is concluded that the proposed Project will not have adverse effects on local air quality during the construction, taking into account the dispersion effect of the wind in the Project area and short duration of the construction. Mitigation measures will be taken to reduce the amount of dust generated and therefore it is not expected that dust generated during construction activities will create any adverse effects on the local air quality. Besides, no air emissions will be generated during operation.

Only domestic wastewater will be generated during construction and operation. During construction a leak-proof septic basin will be built for the disposal of domestic wastewater. The water required for the construction works and dust suppression will be carried in by tanker trucks. Wastewater will be collected in the septic tank and disposed periodically during operation. Drinking water demand of workers will be supplied via bottled water during construction and operation. The domestic wastewater generated during the construction and operation phase will not create any adverse impact on the local environment and natural resources.

Minor amounts of hazardous wastes and waste oil will be generated during construction period of the Project. The proposed Project will not create any adverse impact in the local environment due to the handling, storage, transport and disposal of the hazardous waste and waste oil generated during the construction. Waste oils resulting from yearly maintenance works will be collected by a qualified personnel working at the oil provider company. These wastes will be removed from the Project site in accordance with the Waste Oil Control Regulation. Any hazardous waste will be collected in leak-proof containers and removed to a licensed disposal facility by licensed transporters. Thus, an adverse impact on the local environment is not expected during construction. Non-hazardous wastes will also be generated during construction and operation periods. Recyclable wastes will be segregated from other wastes and stored temporarily on site for eventual recycling process. Excavated soil will be re-used for the filling of the turbine foundation and site leveling purposes. Non-recyclable and non-hazardous solid wastes will be collected within closed bags and these wastes will be collected and properly disposed. It is expected that no medical waste will be generated at the Project site during the construction and operation phase. Health center located at the nearest town will be used for health care purposes.

An adverse impact to soil or groundwater is not expected during the construction and operation phases since proper precautions such as using proper secondary containments while storing chemicals will be taken to prevent potential releases from reaching the environment.

The proposed Project is not expected to create significant impacts on the local biological resources and wildlife in or close proximity to the Project site. Vegetation loss will be limited to the access roads and tower bases and moreover topsoil will be removed and stored on site for future landscaping purposes. There will be an impact on the existing vegetation during site preparation and excavation activities. The most important potential concern of the Project is the risk of collision of birds and bats with the wind turbines. Turbines will be painted and lighting will be installed properly to minimize bird collision risk. Since the Project site is located near the border of Foça Important Bird Area, a monitoring study will be carried out in the first year of operation.

Visual impact of the proposed Project is also assessed. The Project site is not located in a protected area or a tourist/resort area; it is mostly industrial and not considered as an aesthetically significant place. Thus, a visual impact is not considered as significant.

For shadow flicker effect of the Project, a modeling study is performed in order to estimate the shadow casting areas and to create a shadow model for each of the wind turbines. Two shadow receptors, which are closest permanent residences, are selected for the modeling. The modeling results revealed that in realistic case the shadow impact is negligible and it can be stated that the proposed wind farm Project will not cause significant shadow flickering on the closest settlements. In addition, blade glint is not expected to be important since the blades will be made of and painted non reflective materials.

Socio-economic impacts of the Project are assessed for construction, operation and decommissioning phases of the Project. There is not a directly affected community from the Project as the Project area is located on a state-owned land. The socio-economic impacts of the Project are minor and indirect. Employment opportunity during construction and operation phases might provide positive socio-economic impact to the Project when a recruitment approach to hire construction workers from region and especially from Project-affected communities is applied. Land expropriation is not an issue during construction and operation phases of the Project as the projects area is a state-owned land. There will be no physical or economic resettlement associated with the proposed Project.

Public participation and consultation process is conducted. The stakeholders for Karadağ Wind Power Plant consist of the general public, national regulatory authorities, local regulatory authorities, local agencies and non-governmental organizations. Public participation and project disclosure meeting was held in Çakmaklı Village in order to inform the public about the Project. The outcome of the meeting was that all villagers supported the project with no concerns. The villagers encouraged the project owner to start the proposed project as soon as possible to protect the forest land, where the project will be constructed, from further development of heavy industrial activities in the region. The consultation process will also proceed through construction and operation by means of grievance mechanism that will be implemented by GARET and its contractors

Safety risk to local community may arise during construction phase due to increase in traffic and open trench or pit. These impacts are mitigated by informing public about the traffic flow and restricting access of non-authorized people to Project area during construction. Disruption to local infrastructure during construction is mitigated by paying compensation by the project owner. During operation

phase, safety risk to local community is mitigated by restricting access of non-authorized people to project area.

Occupational and community health and safety issues are also assessed in the scope of the ESA study. Working at heights, air craft safety, blade/ice throw, electromagnetic interference and public access issues were addressed in terms of occupational and community health and safety. All the precautions related with working at heights will be taken throughout the construction and operational phases of the proposed Project in accordance with the Turkish Health and Safety laws and regulations and IFC/WB Guidelines. With the proper implementation of health and safety plans and taking the necessary precautions given in the regulations, potential accidents associated with working height would be eliminated.

Proposed Project area is located approximately 54 km north-west of the Adnan Menderes Airport and 28 km north-west of Çiğili Military Airport. Within the Project, the edges of the turbine blades will be painted and lightening system will be installed. The Civil Aviation Law and related international laws will be complied in the scope of the proposed Project. Since, in general the Mediterranean climate is dominant in the region; blade/ice throw will not be a potential risk to threat public safety. There is no aviation radar in the close vicinity of the proposed Project site. The proposed Project is not expected to interfere with the telecommunication systems. The proposed Project will not cause any risk in terms of public access. All the necessary precautions will be taken in order to prevent non-authorized access to Project site. There will be security personnel during the operation period. Hence, entrance of non-authorized people to the wind turbine area will be prevented.

The technology and site alternatives are also evaluated in the scope of the ESA study. Due to the environmental benefits and wind being a renewable power source, generation of electricity with wind turbines is selected as the proposed technology. The proposed site was selected due to the wind potential. GARET constructed two meteorological towers/masts at the proposed Project site in order to evaluate wind energy potential of the region. These masts continue recording data at present. The data acquired from these masts revealed that the area has sufficient wind energy potential to construct wind power plant.

An Action Plan and its Environmental Management System, which addresses the impacts, significance of the impacts, mitigation measures, responsible parties, monitoring methods and frequencies and costs, is also prepared for the proposed Project.

The proposed wind power Project will comply with all relevant Turkish environmental as well as the EP, IFC/WB Guidelines during construction and operation phases. As stated above, potential adverse environmental and social impacts associated with the proposed Project are expected to be generally negligible and will be mitigated fully by GARET.

1.0 INTRODUCTION

1.1 Background to the Project

GARET Enerji Üretim ve Ticaret A.Ş. (GARET) proposes to install a wind power plant (Project) with 10 MW installed capacity in İzmir Province of Turkey. GARET has obtained the “Electric Power Generation License” from the Energy Market Regulatory Authority (EMRA) for the proposed Project. A 49-year license (License No. EU/1632-6/1194, dated June 5, 2008) is granted for the proposed Project by the EMRA under the provisions of Law No. 4628 governing the electricity market in the Republic of Turkey.

According to the Turkish Environmental Impact Assessment (EIA) Regulation, an environmental Project Description Report (PDR) is required for the Project. The PDR was prepared by a local environmental consulting company and submitted to İzmir Provincial Directorate of Environment and Forestry (PDoEF). The PDoEF reviewed the PDR for the Project and decided that a detailed EIA report was not required for the Project. This decision was sent to GARET on January 15, 2009.

The proposed Project is being developed in accordance with the national energy strategy of the Republic of Turkey that enhances diversifying resources for electricity generation and encourages use of renewable energy. The need and objectives of the Project are fully discussed in Section 3.0 of the Environmental and Social Assessment (ESA) report.

GARET Enerji Üretim ve Ticaret A.Ş. was founded on March 29, 2006 to develop and invest in wind energy projects. Application has been submitted to the EMRA for eight wind power projects with a total installed capacity of 220.50 MW. GARET is a subsidiary of GAMA Enerji A.Ş. (GEAŞ). The shareholders of GEAŞ are GAMA Holding and General Electric Energy Financial Services, each holding 50% stake in the company. GAMA Holding is pursuing activities over a wide geographical area, covering the Middle East, Russia, CIS countries, South East Asia, North Africa and Ireland for the last 50 years (see, www.gama.com.tr). GE-EFS is a business unit of the General Electric (GE). GEEFS employs 350 professionals to invest in the energy and water sector.

The ESA report for the Project has been prepared by AECOM Turkey. AECOM is a global leader in providing fully integrated engineering, design and program management services for a broad range of markets, including architecture, building engineering, design and planning, economics, energy, environment, government services, program management, transportation and water. With more than 43,000 employees around the world, AECOM serves clients in more than 100 countries (see, www.aecom.com).

1.2 Purpose and Scope of the ESA

The project owner, GARET, plans to apply international finance institutions for financing of the proposed Project. Therefore, GARET has initiated this ESA to be prepared according to the Equator Principles (EP). The “Equator Principles” is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. The Equator Principles are based on

the IFCs Environmental and Social Safeguard Policies. Thus, this report has been also prepared according to IFCs requirements.

The purpose of the ESA is to identify potential environmental and social impacts of the Project to the local ecosystem and community during construction, operation and decommissioning phases. The ESA also aims at providing mitigation measures to eliminate potential adverse impacts and propose a management and monitoring plan. The ESA evaluates potential impacts in terms of additionally caused by the Project. Thus, an environmental and social baseline data is also assessed within the scope of the ESA. The ESA was carried in the following stages:

- Review of applicable national and international regulations and standards, industry best practice.
- Compilation of a technical description of the project.
- Description of the existing (baseline) environmental conditions within the project area.
- Identification, characterization and quantification of all emissions to air, water and soil during construction, operation and decommissioning phases of the Project.
- Assessment of the environmental impacts of the Project.
- Identification of mitigation measures that minimize or eliminate potential impacts.
- Provision of plans for monitoring programs, auditing and feedback.

The Project is categorized as a “Category B” according to IFC/WB guidelines. The ESA report includes following sections:

1. Executive summary,
2. Policy, legal and administrative framework,
3. Project description,
4. Baseline data,
5. Environmental impact assessment,
6. Analysis of alternatives,
7. Action and management plan, and
8. Public consultation.

Following issues are addressed in the ESA:

- a) Assessment of the baseline social and environmental conditions,
- b) Consideration of feasible environmentally and socially preferable alternatives,
- c) Requirements under Turkish laws and regulations, applicable international treaties and agreements,

- d) Community health and safety,
- e) Protection of cultural property and heritage,
- f) Protection and conservation of biodiversity, including endangered species and sensitive, ecosystems in modified, natural and critical habitats, and identification of legally protected areas,
- g) Sustainable management and use of renewable natural resources,
- h) Use and management of dangerous substances,
- i) Occupational health and safety,
- j) Socio-economic impacts,
- k) Cumulative impacts of existing projects, the proposed Project, and anticipated future projects,
- l) Consultation and participation of affected parties in the design, review and implementation of the project,
- m) Pollution prevention and waste minimization, pollution controls (liquid effluents and air emissions) and solid and chemical waste management.

2.0 LEGAL FRAMEWORK

2.1 Turkish Environmental Legislation

The Environmental Law (No. 2872), which was published in Turkish Official Gazette No. 18132 dated August 11, 1983 and lastly revised in Turkish Official Gazette No. 26167 dated May 13, 2006 (Law No. 5491) provides the legislative framework for the regulation of industries and their potential impact on the environment. Industrial projects are subject to varying levels of review that begin while projects are in the development and pre-operation phases. Additional regulations apply to facilities once they are in operation.

The Environmental Law authorized the promulgation of a number of regulations. Those that pertain to development and operation of wind projects are the following:

- Environmental Impact Assessment Regulation, Official Gazette No. 26939 dated July 17, 2008.
- Regulation on Assessment and Management of Environmental Noise, Official Gazette No. 26809 dated March 07, 2008;
- Water Pollution Control Regulation, Official Gazette No. 25687 dated December 31, 2004 and revised in Official Gazette No. 26786 dated February 13, 2008;
- Regulation on Construction of Cesspits where there is no Wastewater Collection System, Official Gazette No. 13783 dated March 13, 1971;
- Hazardous Chemicals Regulation, Official Gazette No. 21634 dated July 11, 1993 and revised in Official Gazette No. 27092 dated December 26, 2008;
- Regulation on General Principles of Waste Management, Official Gazette No. 26927 dated July 5, 2008;
- Hazardous Wastes Control Regulation, Official Gazette No. 25755 dated March 14, 2005 and revised in Official Gazette No. 27339 dated September 04, 2009;
- Waste Oil Control Regulation, Official Gazette No. 26952 dated July 30, 2008 and revised Official Gazette No. 27305 dated July 31, 2009;
- Vegetative Waste Oil Control Regulation, Official Gazette No. 25791 dated April 19, 2005; and revised Official Gazette No. 27305 dated July 31, 2009
- Solid Waste Control Regulation, Official Gazette No. 20814 dated March 14, 1991 and revised in Official Gazette No. 25777 dated April 5, 2005;
- Medical Waste Control Regulation, Official Gazette No. 25883 dated July 22, 2005;
- Packaging Waste Control Regulation, Official Gazette No. 26562 dated June 24, 2007 and revised in Official Gazette No. 27046 dated November 6, 2008;
- Waste Batteries and Accumulators Control Regulation, Official Gazette No. 25569 dated August 31, 2004 and revised in Official Gazette No. 25744 dated March 03, 2005;

- The Excavation, Construction and Demolition Waste Control Regulation, Official Gazette No. 25406 dated March 18, 2004;
- Soil Pollution Control Regulation, Official Gazette No. 25831 dated May 31, 2005;
- Regulation on Protection of Wetlands, Official Gazette No. 25818 dated May 17, 2005;
- Regulation Related to Workplace Opening and Operation Permits, Official Gazette No. 25902 dated August 10, 2005 and revised in Official Gazette No. 26492 dated April 13, 2007;
- Industrial Air Pollution Control Regulation, Official Gazette No. 27277 dated July 3, 2009
- Air Quality Assessment and Management Regulation, Official Gazette No. 26898 dated June 6, 2008 and revised in Official Gazette No. 27219 and dated May 5, 2009;
- Air Pollution Control Regulation For Heating Sources, Official Gazette No. 25699 dated January 13, 2005 and revised in Official Gazette No. 27134 dated February 07, 2009;
- Exhaust Gases Emission Control Regulation, Official Gazette No. 27190 dated April 04, 2009; and
- Regulation for Control of the Tires Which Have Completed Their Life, Official Gazette No. 26327 dated November 25, 2006.

In addition to the Environmental Law and its associated regulations, there are several other laws that directly or indirectly include environmental review, and thus, are applicable to the proposed Project. The Project will comply with the 4857 numbered Labor Law and its regulations stated below:

- Occupational Health and Safety Statute, Official Gazette No. 14765 dated April 11, 1974;
- Health and Safety Regulation for Construction Works, Official Gazette No. 25325 dated December 23, 2003; and
- Regulation on Health and Safety Regarding Temporary Works, Official Gazette No. 25463 dated May 15, 2004.

Other regulations that the Project will comply with can be listed as follows:

- 5346 numbered Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy;
- Regulation on Protection and Usage of Agricultural Lands, Official Gazette No. 25766 dated March 25, 2005;
- 2863 numbered Law on Protection of Cultural and Natural Heritage (revised by 5226 numbered Law);
- 4342 numbered Pasture Law;
- 6831 numbered Forestry Law (amended by 5192 numbered Revision in Forestry Law);
- Regulation on Buildings located on the Disaster Areas, Official Gazette No. 26582 dated July 14, 2007;

The following sections provide brief explanations of the regulations that are relevant to the proposed Karadağ Wind Power Project (KWPP).

2.1.1 Environmental Impact Assessment

The first Environmental Impact Assessment (EIA) Regulation was published in Official Gazette No. 21489 dated February 7, 1993. The EIA regulation was subsequently revised three times and reissued in Official Gazette on June 23, 1997, June 6, 2002 and December 16, 2003. The final version of EIA Regulation was published on July 17, 2008 in Official Gazette No. 26939. The purpose of the EIA regulation is to define the administrative and technical aspects that must be followed during an environmental impact assessment process.

The scope of the EIA regulation includes the following:

- Determination of the type of projects required to prepare an environmental impact assessment report or a project description report and the issues to be covered in these applications or reports;
- The technical, administrative and legal aspects related to the environmental impact assessment process;
- The work related to the establishment of the Scope Definition, Review and Evaluation Committee; and
- Monitoring and auditing of the projects subject to this regulation, prior to the commissioning phase, during the operational phase and the decommissioning phase.

According to Article 6 of the EIA regulation, projects should either submit an Environmental Impact Assessment (EIA) Report or Project Description Report (PDR) based on the classification of the projects listed in Annex I and Annex II of the EIA regulation. Annex I and Annex II define the type and projects that are subject to preparing and submitting an EIA Report and PDR, respectively.

The projects that are listed in Annex II should prepare a PDR and apply to the Provincial Environment and Forestry Directorate by submitting a report that includes a project description and information according to the format given in the Annex IV of EIA Regulation. The Directorate reviews the report in 5 days and may ask for detailed information on the project or request analysis or measurements in the project area. The Directorate gives a final decision in as “EIA is not Required” or “EIA is Required” for the project after the submission of the final Project Description Report.

An “EIA is not Required” opinion means that the proposed Project does not need to prepare and submit a detailed EIA report to the MOEF. The project can obtain other resources permits as required by the relevant Turkish regulations. An “EIA is Required” opinion means that the EIA procedures outlined in the EIA regulation should be followed to prepare a detailed EIA report and to obtain an approval for the project from the MOEF.

The wind farm projects are included in Annex II of the EIA Regulation. Thus, the proposed KWPP should submit a Project Description Report. The project owner has prepared a Project Description Report and applied to the İzmir Provincial Environment and Forestry Directorate for development consent. GARET has obtained an “EIA is not Required” opinion from the provincial directorate for the proposed Project.

2.1.2 Air Quality

The Industrial Air Pollution Control Regulation (IAPCR) was published in the Official Gazette No. 25606 on October 7, 2004 and revised and re-issued in Official Gazette No. 26236 dated July 22, 2006. This regulation was abolished currently by a new Industrial Air Pollution Regulation published in the Official Gazette No. 27277 dated July 3, 2009. Similar to previous regulation, the purpose of the new IAPCR is to control soot, fume, dust, gas, vapor, and aerosols emitted to the atmosphere resulting from the activities of industrial and energy production facilities, to protect and prevent the environment and human beings from atmospheric pollution hazards, to eliminate adverse impacts due to air pollution which cause harm to the general public and to ensure that such impacts do not emerge.

The Air Quality Assessment and Management Regulation (AQAMR) was published in the Official Gazette No. 26898 on June 6, 2008. The regulation amended and re-issued in Official Gazette No. 27219 and dated May 5, 2009. The purpose of the AQAMR is to define and establish objectives for ambient air quality designed to prevent or reduce harmful effects on human health and the environment, to assess the ambient air quality on the basis of common methods and criteria, to maintain air quality where it is good and improve it in other cases and to obtain adequate information on ambient air quality and ensure that the such information on ambient air quality is available to the public.

Air Pollution Control Regulation for Heating Sources (APCRH) was published in the Official Gazette No. 25699 dated January 13, 2005. The regulation amended and re-issued firstly in Official Gazette No. 25758 dated March 17, 2005 and secondly in Official Gazette No. 26522 dated May 14, 2007. The Regulation recently amended on February 7, 2009 in Official Gazette No. 27134. The purpose of the APCRH is to reduce and control harmful effects of soot, fume, dust, gas, vapor, and aerosols emitted to the atmosphere resulting from the heating sources used in places such as residences, schools, universities, hospitals, offices, social facilities and industrial facilities. Exhaust Gases Emission Control Regulation (EGECR) was published in the Official Gazette No. 27190 dated April 04, 2009 and supersedes the Regulation on Control of Exhaust Emissions of Motorized Vehicles published in the Official Gazette No. 25869 dated August 7, 2005. The purpose of the EGECR is to determine the necessary methods and principles regarding reduction of the exhaust gas pollutants and control of the pollutants via measurements to protect the living organisms and environment from the air pollution and its effects of exhaust emission caused by the motorized vehicles in traffic. This regulation does not cover the construction vehicles.

The proposed Karadağ Wind Power Project (KWPP) will generate fugitive dust emission due to excavation works and exhaust emissions due to heavy construction vehicles during the construction

phase. The proposed KWPP will not have any point or fugitive emission and heating source emissions during operation other than an emergency diesel generator.

Emission Limits

The IAPCR defines emission limits according to the industrial activity and the type of combustion unit and the fuel used. The regulation sets emission limits for the following pollutants: sulfur dioxide (SO₂), nitrogen oxides (NO and NO₂), particulate matter (PM), carbon monoxide (CO), formaldehyde and hydrogen sulfur (H₂S). In addition, the IAPCR also provides emission limits for hazardous (non-carcinogenic) and carcinogenic organic gas and vapor emissions. The IAPCR categorizes hazardous and carcinogenic organic compounds into three groups.

The proposed KWPP will not generate any emission due to its operation. As indicated above, air emissions are generated only during the construction phase. In accordance with the IAPCR, monthly average settled dust amount generated due to loading, unloading, sieving, transporting, crushing and milling activities of particulates should not exceed 450 mg/m².day. There is no limit value defined for the exhaust emissions of heavy construction vehicles in the Turkish Environmental Legislation.

Ambient Air Quality

Air Quality Assessment and Management Regulation defines ambient air quality limits for two regulatory periods. The first period is transitional period which is until December 31, 2013. The transitional period ambient air quality standards are given in Annex-IA of AQAMR. Limit values for ambient air quality standards after transitional period are given in Annex I of AQAMR. Wind power generation is a non-combustion process that relies on the direct conversion of mechanical energy into electrical energy and no air emission will be generated due to operation of the plant and thus the Project will not have any impact on the local ambient air quality. The emission generated in the construction phase will be temporary and will have minor effect on the local ambient air quality.

2.1.3 Wastewater

Water Pollution Control Regulation (WPCR) was published in Official Gazette No. 25687, dated December 31, 2004 and revised and re-issued in Official Gazette No. 26786 dated February 13, 2008. The aim of the WPCR is to determine the necessary legal and technical principles in order to protect surface and groundwater resources, provide sustainable water use and prevent water pollution in harmony with sustainable development objectives.

The WPCR covers water quality classes and utilization purposes, planning principles and prohibitions concerning protection of water quality, wastewater discharge principles and discharge permits, applications in wastewater infrastructure facilities and monitoring and auditing principles in order to prevent water pollution. Industries are categorized according to their sectors in the WPCR. The WPCR presents “sector-specific” discharge limits for numerous types of wastewater discharges. The WPCR also sets the discharge limits for domestic wastewaters according to pollution load.

For facilities, located in an area where sewer collection system is not available and having a population less than 84 employees, the WPCR allows the construction of an impervious septic tank or

basin for disposal of domestic wastewaters. Wastewater in the septic tank should be pumped out with a vacuum truck and wastewater should be transported to a wastewater treatment plant. In addition, the wastewater generators collecting their domestic wastewaters in an impervious cesspit and discharging to wastewater infrastructure system through transporting by vacuum trucks should keep the protocol with Wastewater Administration and the receipts of disposal of wastewater by vacuum truck for five years and declare them to the officials during audits.

The proposed KWPP will not generate industrial wastewater. Only domestic wastewater will be produced during the construction and operation phases.

Since domestic wastewater will not be directly discharged to the receiving environment, the wastewater discharge standards for the domestic wastewater given in the WPCR are not applicable for the proposed Project.

2.1.4 Soil Pollution

The Soil Pollution Control Regulation (SPCR) was published in Official Gazette No. 24609, dated December 10, 2001 and re-issued in Official Gazette No. 25831 dated May 31, 2005. The purpose of the SPCR is to prevent soil pollution and to undertake required measures to clean up soil contamination.

In accordance with the SPCR, it is obligatory to prevent pollution, stop pollution in the polluted areas and determine the extent of pollution and carry out. The facility is liable to assure that any type of waste and residue are not discharged, stored directly or indirectly to the receiving environment in compliance with the standards and procedures stated in the Environmental Law and the relevant Regulations in a way that they do not harm soil and cause soil pollution. According to the SPCR, it is the responsibility of the facility owner to remediate (i.e., clean-up) contaminated soil. In addition, after remediation parameters listed in the regulation should be analyzed and the samples should comply with the limit values for these parameters.

The proposed Project must comply with the SPCR during the construction and operation phases.

2.1.5 Noise

Regulation on Assessment and Management of Environmental Noise (RAMEN) published in Official Gazette No. 26809 dated March 7, 2008. The purpose of the RAMEN is to take necessary precautions in order to prevent the disturbance of the comfort and tranquility of public and ensure physical and mental health of human beings due to exposure to environmental noise.

The RAMEN covers principles and criteria regarding environmental noise to which humans are exposed in particular in built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise sensitive buildings and areas and environmental vibration causing damages to the buildings.

The RAMEN lists the facilities that should secure noise control permit. The wind farm projects are not included in this list. Thus, the proposed Project is not obliged to secure a noise control permit.

However, the Project must prepare environmental noise assessment reports during “workplace opening and operation permitting” phase and/or during programmed, not programmed or complaint basis audits if the competent authority requests.

The KWPP site is located in an industrial area where there are also villages in close vicinity. The nearest settlements to the Project site are Çakmaklı and Horozgediği Villages. According to the RAMEN, the noise level criteria (for day, night and evening periods) for the industrial facilities are categorized into four groups according to sensitivity of the area (see, Table 2-1). The Project is subject to limits given in the category which is referred to as “areas with both noise sensitive areas and industrial activities (predominantly industrial)”. Noise levels due to industrial sources for the areas included in this category should not exceed the daytime (07:00–19:00) limit of 68 dBA, the evening time (19:00–23:00) limit of 63 dBA and the night time (23:00–07:00) limit of 58 dBA at the closest sensitive receptor. Thus, the proposed Project should not exceed these limits during operation.

Table 2-1 Turkish Noise Level Limits

Areas	L _{day} (dBA)	L _{evening} (dBA)	L _{night} (dBA)
Noise sensitive areas such as place of education, cultural activities, health center and summer resorts and camping sites	60	55	50
Areas with both noise sensitive areas and industrial activities (predominantly residential)	65	60	55
Areas with both noise sensitive areas and industrial activities (predominantly industrial)	68	63	58
For each facilities that are in organized industrial zone or industrial region	70	65	60

The RAMEN also sets the noise level limits for construction sites. The limits are given in Table 2-2. The proposed Project should comply with these limits during construction phase.

Table 2-2 Noise Limits for Construction Sites

Type of Activity (construction, demolition, restoration)	L _{day} (dBA)
Building	70
Road	75
Other Resources	70

Various equipment and machinery will be used during the construction phase of the Project. Thus, the Project should also comply with the limits stated in the Regulation on Noise Emission by Outdoor Equipment which was published in the Official Gazette No. 26392 dated December 30, 2006.

In accordance with Regulation on Management and Assessment of Environmental Noise, information related to starting and finishing dates and working durations of the construction and the permits obtained from municipalities should be displayed on a signboard that can easily be seen by everyone.

2.1.6 Waste

Regulation on General Principles of Waste Management was published in Official Gazette No 26927 dated on June 5, 2008. The purpose of the regulation is to provide waste management without causing harm to the environment and human health.

It is indicated in Article 5 of the Regulation that waste generators are obliged to decrease the amount of waste and its hazardous properties, utilize methods for separation, collection, transportation, recycling and disposal operations that will not cause a risk for water, air, soil, flora and fauna. In addition, according to Article 11 of the Regulation, the waste generating facilities should record the waste quantity, source, type and the corresponding waste code given in the annex part of this regulation, disposal facility the waste was sent and applied processes and keep the records for at least five years; submit them to the Ministry on periods determined by Ministry; and make them accessible for the inspection of Ministry.

The regulation also includes the list of hazardous and non-hazardous wastes and their waste codes, their way of recycling and disposal methods and properties of hazardous wastes. The proposed Project must comply with the Regulation on General Principles of Waste Management.

2.1.6.1 Solid Waste

Solid Waste Control Regulation (SWCR) was published in Official Gazette No. 20814 dated March 14, 1991 and amended in Official Gazette No. 25777 dated April 5, 2005. The aim of the SWCR is to prohibit the disposal of any kinds of wastes and residues to receiving bodies directly or indirectly in a manner harmful for the environment. In addition, the storage, transportation and removal of the waste should be conducted such that damages of pollutants which make permanent effects in air, water, earth and on animals, plants, natural resources and ecological balance should be prevented.

In accordance with Article 4 of the SWCR, facilities generating solid wastes are liable to choose the technology generating the least quantity of solid waste, to reduce the amount of solid waste quantity of the existing production, to eliminate harmful materials from the solid wastes and participate in and contribute to the efforts of recycling of materials.

According to Article 8 of SWCR, domestic solid wastes and the used batteries, used accumulators, medical wastes, used vehicle tires, packaging wastes and recyclables wastes should be disposed of separately. In addition, it is also indicated that disposal of solid wastes by waste generating or transporting parties to seas, lakes and similar receiving environments, streets, forests and other places where environment would be adversely affected is prohibited.

According to the SWCR, facilities generating domestic wastes and industrial sources with domestic wastes are required to collect their solid wastes in the facilities where they are produced, as required by the municipalities. Within the municipality boundaries, the municipality is responsible for providing

collection services and the disposal of domestic waste from industrial sources. However, industrial facilities out of municipal borders are responsible for transportation of their wastes. The generators are obliged to keep the garbage containers closed in such manner not to cause any harm to the environment and to make them ready on the street at the time of collection of garbage.

Excavation, Construction and Demolition Wastes

The Excavation, Construction and Demolition Waste Control Regulation was published in Official Gazette No. 25406 dated March 18, 2004. The aim of this regulation is to set the principles and procedures firstly to minimize the excavation, construction and demolition wastes at the source of generation and to collect, temporarily store, transfer, recycle, reuse and dispose them in a manner not to cause harm to the environment.

In accordance with Article 9 of the regulation, excavation, construction and demolition generating facilities are obliged to provide the waste management in a way that will minimize the adverse effects of wastes on the environment and human health. The facilities must acquire the necessary permissions that concern the generation, transportation and storage operations of the wastes. The facilities are not allowed to dump construction wastes to the sites/locations and facilities other than the permitted ones by the municipal or other authorities.

The regulation also stipulates that the project owner is responsible for having precautions in order to minimize noise or visual impacts and dust emissions during removal of excavation soil and for closing the sides of the operation area. In addition, planning should be done in a way that the amount of excavation soil is equalized to the filling volume and excavation soils are utilized within the operation area. In addition, in accordance with the regulation, top soil should be collected separately from subsoil during excavation. The slope of the area where top soil will be stored could not be more than 5 %. Any loss during storage of topsoil should be prevented and quality of the soil should be preserved. In case, topsoil will be left open for a long time, surface of the topsoil should be covered with fast growing plant.

Packaging Wastes

The Packaging Material and Packaging Waste Control Regulation (PWCR) was published in the Official Gazette No. 26562 dated June 24, 2007. The aim of the PWCR is to provide production of packages with certain environmental criteria, requirements and characteristics; to prevent direct and indirect release of package wastes causing environmental damage; to prevent formation of package wastes; and to reduce the amount of those, which cannot be prevented, by means of reuse, recycling and recovery methods.

Article 26 of PWCR states that the package wastes should be collected and stored separately from the other wastes at source in order to ensure their disposal without causing any environmental damage; to reduce environmental pollution; to benefit from the landfills at maximum levels; and to contribute to the economy. Packaging waste generating parties located in the boundaries of districts which conduct separate collection at source is obliged to deliver the packaging wastes to the responsible municipalities or their contracted and licensed collection/separation entities.

The Project must comply with the Solid Waste Control Regulation, the Excavation, Construction and Demolition Waste Control Regulation and the Packaging Material and Packaging Waste Control Regulation during the construction and operation phases.

2.1.6.2 Hazardous Waste

The Hazardous Wastes Control Regulation (HWCR) was published in Official Gazette No. 25755 dated March 14, 2005 and revised in Official Gazette No. 27092 dated December 26, 2008. The purpose of the HWCR is to prevent direct and indirect disposal of hazardous wastes in a manner that can adversely affect human health and the environment; control the production of and transportation of hazardous wastes; minimize production of hazardous wastes at the source and specify that disposal of hazardous wastes be at the closest appropriate location to the site of generation. The regulation aims to determine the principles and procedures in order to provide the management of hazardous wastes in conformity with the environment from the generation phase until the final disposal phase.

According to Article 9 of HWCR, the hazardous waste producers are obliged to take the required precautions in order to minimize hazardous waste generation; to provide waste management in a way that minimizes the adverse affects of wastes on human health and environment; to prepare 3-year waste management plan within six months from the issue date of this Regulation and obtain approval from the Governorate; to record the hazardous wastes generated, prepare Waste Declaration Form in Annex 8 in January of each year for the last year's information and submit to the Ministry within two months; to provide proper packaging and labeling; and to dispose and transfer the hazardous wastes in conformity with the principles stated in the regulation.

According to HWCR, facilities are required to secure a permit from local Governorate in case of temporary onsite storage of their wastes. However, facilities producing less than 1,000 kg/month of hazardous wastes may store these waste temporarily onsite for up to 180 days without obtaining a permit from the local Governorate. In this situation, the total amount of the collected waste must not exceed 6,000 kg at any time.

In case of temporary onsite storage of hazardous wastes, the hazardous wastes should be stored in containers that are non-damaged, leak-proof, safe and appropriate for the international standards, on concrete place within the land of the facility, away from the plants and buildings. "Hazardous waste" label should be placed on the containers and this label should also indicate the amount of stored waste as well as the storage time of the hazardous waste. In case the containers are damaged, wastes should be transferred to the other containers with the same properties. Containers should be kept closed and wastes should be stored in a way that they will not go in chemical reactions.

Transportation of the wastes should be done by the licensed persons and entities with appropriate vehicles for the properties of the transported waste. The vehicles that are used to transport hazardous wastes should carry a waste transport form as specified in the regulation. The HWCR also contains a list of hazardous materials, their properties and their way of disposal.

Battery and Accumulator Wastes

The Waste Batteries and Accumulators Control Regulation was published in Official Gazette No. 25569 dated August 31, 2004 and amended in Official Gazette No. 25744 dated March 03, 2005. The purpose of this Regulation is to arrange legal and technical principles to determine principles, policies and programs for used batteries and accumulators from their production to their final disposal; to ensure production of batteries and/or accumulators with certain criteria and basic conditions and characteristics in terms of the environment; to prevent the discharge to the receiving environment directly or indirectly damaging human health and the environment; to ensure technical and administrative standards necessary in their management; to establish a collecting system for the recovery and final disposal of used batteries and accumulators and compose a management plan.

According to Article 13 of the Waste Batteries and Accumulators Control Regulation the battery and accumulator consumers are obliged to collect used batteries separately from household wastes, and deliver used batteries to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities; to deliver the old accumulator when replacing their vehicles' accumulators to the temporary storage places established by the enterprises engaged in the distribution and sale of accumulator products and enterprises operating vehicle maintenance/repair sites free of charge; and pay a deposit if a new accumulator is to be purchased when delivering the old one and not to keep accumulators of benches, facilities, forklift, tractors and other motor vehicles, power supplies and transformers used in the production processes of consumer industrial facilities after the accumulators become a waste longer than 90 days on impervious ground within the factory site until they are delivered to the producer. The Article 15 of the Regulation stipulates that the transportation of waste accumulators from the point of collection to the temporary storage or to the disposal facility by the highway should be carried out using an appropriate vehicle according to the type of waste by real and legal entities who have obtained a transportation license from the Governorate.

Some minor amount of hazardous waste will be generated during construction and operation of the proposed KWPP. The Project must comply with the requirements of the Hazardous Wastes Control Regulation and the Waste Batteries and Accumulators Control Regulation during construction and operation phases.

2.1.6.3 Waste Oil

Waste Oil Control Regulation (WOCR) was published in the Official Gazette No. 26952 dated June 30, 2008. The purpose of the WOCR is to prevent direct and indirect disposal of waste oils to receiving environment; to ensure temporary storage, transportation and disposal thereof without causing harm to environment and human health; to set up necessary technical and administrative standards in management of waste oils; to determine the required principles and programs in order to establish temporarily storage, handling and disposal facilities and manage these facilities in an environmental friendly manner.

According to Article 9 of WOCR, waste oil producers are obliged to take required measures to minimize the generation of waste oils including waste motor oils and residues resulting from

processing of waste oils. Waste oil producers must conduct waste oils analyses once at licensed laboratories in case there is no change in the oil type used, and declare to the Ministry of Environment. The waste oils of different category should not be mixed with each other, PCB and other hazardous wastes. Waste oils contaminated with hazardous wastes should be disposed in accordance with the Hazardous Waste Control Regulation. Waste oils should be transported by licensed transporters to the licensed processing and disposal facilities. The National Transportation Form in the case of transporting the waste oil out of the facility and waste oil declaration form annually must be prepared and submitted to the competent authority before the end of February. All records including waste oil declaration forms, analyses report and national waste transportation form should be kept for at least five years.

Waste oil should be collected in tanks/containers placed on an impermeable ground whose thickness is at least 25 cm and covered by epoxy, geo-membrane and similar insulation materials and waste accumulation areas should be protected from the rain. Furthermore it is required to store waste oils in red colored tanks/ containers with a label of "Atık Yağ" ("Waste Oil") on it. Waste oils of different categories should not be mixed with each other. Any foreign substance like water, gasoline, fuel-oil, dye, detergent, solvent, antifreeze and diesel oil should not be mixed with the oil in these tanks/containers.

The Project must comply with the requirements stated in the Waste Oil Control Regulation.

2.1.6.4 Medical Wastes

The Medical Waste Control Regulation (MWCR) was published in Official Gazette No. 25883 dated July 22, 2005. The purpose of the MWCR is to establish principles, policies, and programs along with legal, administrative, and technical fundamentals to prevent direct or indirect discharge of medical waste into receiving environment in any way that could harm the environment or human health. The Regulation also requires that medical waste must be collected separately at source and be transported, temporarily stored and disposed of without causing harm to environment or human health.

The Project must comply with the Medical Waste Control Regulation during the construction and operation phase of the Project.

2.1.7 Hazardous Chemicals

The Hazardous Chemicals Regulation (HCR) was published in Official Gazette No. 21634, dated July 11, 1993 and amended in Official Gazette No. 26450 dated March 02, 2007. The purpose of the HCR is to set forth the principles and procedures in order to control hazardous chemicals so that they will not cause harm to the environment and human health.

According to HCR, hazardous materials and products cannot be dumped in the environment in the form of piles without packaging and storage. The facilities which store hazardous chemicals should comply with the principles stated in the regulation. Necessary precautions, such as thermal isolation, ventilation, lightning protection, alarm and fire extinguishing systems, should be provided areas where

hazardous chemicals are stored. Proper labels showing the possible hazards from the handling and usage of the hazardous chemicals and the required precautions should be placed at the storage areas.

Material Safety Data Sheets (MSDS) for the hazardous chemicals should be maintained and stored onsite. MSDS's should contain information about the characteristics and properties of the hazardous chemicals, possible hazards and the necessary precautions, which should be taken at the facility.

There will be a minor amount of hazardous material stored and used during construction and operation of the proposed Project. The Project must comply with the requirements of the Hazardous Chemicals Regulation.

2.2 International Conventions Adopted by Turkey

Turkey signed the many international conventions and agreements to protect its environment and biodiversity. Potential related international conventions with wind energy plants are the following:

- Convention on Biological Diversity, approved by 4177 numbered Law dated August 29, 1996 and published in the Official gazette No. 22860 and dated December 27, 1996, Ratified 1997;
- Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES), published in the Official Gazette No.22672 and dated June 20, 1996, Ratified 1996;
- Convention On The Conservation Of European Wildlife And Natural Habitats (Bern), published in the Official Gazette No. 18318 and dated February 20, 1984, Ratified 1984;
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar), published in the Official Gazette No. 21937 and dated May 17, 1994, Ratified 1994;
- International Convention For the Protection of Birds, published in the Official Gazette No. 12480 and dated December 17, 1966, Ratified 1967; and
- Convention Concerning the Protection of the World Cultural and Natural Heritage, published in the Official Gazette No. 17959 and dated February 14, 1983.

The Project must comply with the relevant provisions of conventions mentioned above.

2.3 Equator Principles

The Project is assessed in accordance with the Equator Principles (EP). The "Equator Principles" is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. The Principles apply to all new project financings globally with total project capital costs of US\$10 million or more, and across all industry sectors.

The Equator Principles (2006) that are adopted by the Equator Principles Financial Institutions (EPFIs) are listed below:

o **Principle 1: Review and Categorisation**

The project is categorised based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC).

o **Principle 2: Social and Environmental Assessment**

A Social and Environmental Assessment is prepared to address the relevant social and environmental impacts and risks of the proposed. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed Project.

o **Principle 3: Applicable Social and Environmental Standards**

The Social and Environmental Assessment refers to the applicable IFC Performance Standards and the applicable IFC Industry Specific EHS Guidelines.

o **Principle 4: Action Plan and Management System**

The Action Plan describes and prioritises the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Social and Environmental Assessment. Borrowers establish a Social and Environmental Management System that addresses the management of these impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable IFC Performance Standards and EHS Guidelines, as defined in the Action Plan.

o **Principle 5: Consultation and Disclosure**

Project affected communities are consulted with in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process ensures their free, prior and informed consultation.

o **Principle 6: Grievance Mechanism**

Grievance mechanism allows the borrower to receive and facilitate resolution of concerns and grievances about the project's social and environmental performance raised by individuals or groups from among project-affected communities.

o **Principle 7: Independent Review**

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower reviews the Assessment, Action Plan and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.

o **Principle 8: Covenants**

For Category A and B projects, the borrower covenants in financing documentation; a) to comply with all relevant host country social and environmental laws, regulations and permits in all material respects, b) to comply with the Action Plan during the construction and operation of the project in all material respects, c) to provide periodic reports in a format agreed with EPFIs,

d) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

o **Principle 9: Independent Monitoring and Reporting**

For all Category A projects, and as appropriate, for Category B projects, in order to ensure ongoing monitoring and reporting over the life of the loan, EPFIs require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.

o **Principle 10: EPFI Reporting**

Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations

The Equator Principles are based on the IFCs Environmental and Social Safeguard Policies. Thus, the IFC/World Bank environmental, health and safety guidelines are described in the following section.

2.4 World Bank/IFC Environmental, Health, and Safety Guidelines

The Project is assessed in accordance with the IFC guidelines, performance standards and their related guidance notes, and manuals related to environmental, social, health and safety issues. The documents guided the ESA study are listed in the following sections.

Guidelines:

- IFC Environmental, Health, and Safety General Guidelines (2007); and
- IFC Environmental, Health, and Safety Guidelines for Wind Energy (2007)

The IFC EHS Guidelines for wind energy defines the environmental issues specific to the operation of wind energy projects and facilities as visual impacts, noise, species mortality or injury and disturbance, light and illumination issues, habitat alteration and water quality. The Guidelines state that wind energy facilities do not normally generate process emissions and effluents during their operation and it also emphasizes that guideline values for process emissions and effluents in this sector are indicative of good international industry practice as reflected in relevant standards of countries with recognized regulatory frameworks. Air emissions, wastewater discharges, and solid wastes related to construction and decommissioning activities are evaluated in accordance with the EHS General Guidelines.

The Guidelines also addresses the occupational and community health and safety hazards during the construction, operation, and decommissioning of wind energy conversion projects which are generally similar to those of most large industrial facilities and infrastructure projects. The occupational health and safety hazards may include physical hazards such as working at heights, working in confined

spaces, working with rotating machinery, and falling objects. According to the guidelines occupational health and safety hazard specific to onshore wind energy facilities is working at heights. Whereas the major community health and safety hazards are aircraft safety, blade and ice throw, electromagnetic interference and radiation and public access.

Performance Standards:

- IFC Performance Standards on Social and Environmental Sustainability (2006),
 - o Performance Standard 1 - Social and Environmental Assessment and Management Systems
 - o Performance Standard 2 - Labor and Working Conditions
 - o Performance Standard 3 - Pollution Prevention and Abatement
 - o Performance Standard 4 - Community Health, Safety and Security
 - o Performance Standard 5 - Land Acquisition and Involuntary Resettlement
 - o Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resources Management
 - o Performance Standard 7 - Indigenous People
 - o Performance Standard 8 - Cultural Heritage
- IFC Guidance Notes: Performance Standards on Social and Environmental Sustainability (2007).

IFC's Performance Standards and related guidance notes are followed in the ESA. The overall content of the ESA is formulated in accordance with the Guidance Note on Performance Standard 1. Guidance notes for Performance Standard 2 to 8 are addressed when applicable. Performance Standard 7 is not applicable to the Project.

Good Practice Manuals:

- A Good Practice Manual: Doing Better Business through Effective Public Consultation and Disclosure,
- A Good Practice Note: Addressing the Social Dimensions of Private Sector Projects (2003),
- Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets (2007).

These manuals are used to prepare public consultation and social assessment sections of the ESA.

Operational Manuals:

- Operational Manual OP 4.01 – Environmental Assessment (1999).

The Operational Manual and Annex A, Annex B and Annex C of the Manual are followed in the ESA.

In general, content of the ESA was in accordance with the "IFC Environmental, Health, and Safety Guidelines for Wind Energy" (IFC, 2007a). "IFC Environmental, Health, and Safety General Guidelines" (IFC, 2007b) are also followed in the ESA. Following sections provide a brief explanation of the IFC's General EHS Guidelines.

2.4.1 Noise

Wind turbines produce noise when operating. The noise is generated primarily from mechanical and aerodynamic sources. The Noise Guidelines addresses the impacts of noise beyond the property boundary of the facilities. According to the Guidelines, noise impacts should not exceed the levels presented in Table 2-3 below, or result in a maximum increase in background levels of 3 dBA at the nearest receptor location off-site.

Table 2-3 Noise Limits

Receptor	One Hour L_{Aeq} (dBA)	
	Day Time (07:00-22:00)	Night Time (22:00-07:00)
Residential; Institutional; Educational	55	45
Industrial, Commercial	70	70

Measures to prevent and control noise are mainly related to engineering design standards. For example, broadband noise is generated by air turbulence behind the blades and increases with increasing blade rotational speed. This noise may be controlled through the use of variable speed turbines or pitched blades to lower the rotational speed.

Additional recommended noise management measures by IFC include:

- Proper siting of wind farms to avoid locations in close proximity to sensitive noise receptors (e.g. residences, hospitals, and schools);
- Adherence to national or international acoustic design standards for wind turbines (e.g. International Energy Agency, International Electrotechnical Commission [IEC], and the American National Standards Institute).

2.4.2 Air Emissions and Ambient Air Quality

The proposed facility should avoid, minimize, and control adverse impacts to human health, safety and the environment from emissions to air. If this is not possible the generation and release of emissions should be managed through a combination of energy use efficiency, process modification, selection of fuels or other materials that may result in less polluting emissions, application of emission control techniques.

According to the General EHS Guidelines, projects with significant sources of air emissions and potential for significant impacts to ambient air quality should prevent or minimize these impacts. In this respect, the emissions of the projects should not result in pollution concentrations that reach or exceed relevant ambient air quality guidelines and standards by applying national legislated standards or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources. In addition, the emissions should not contribute a significant portion to the

attainment of relevant ambient air quality guidelines and standards. The air pollutant limit levels presented in WHO Ambient Air Quality Guidelines are given in Table 2-4 below.

Table 2-4 WHO Ambient Air Quality Guidelines Air Pollutant Limit Levels

Pollutant	Averaging Period	Guideline Value ($\mu\text{g}/\text{m}^3$)
Sulfur dioxide (SO_2)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO_2)	1 year	40 (guideline)
	1 hour	200 (guideline)
Particulate Matter PM_{10}	1 year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24 hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $\text{PM}_{2.5}$	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10(guideline)
	24 hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Wind farm projects are superior amongst other energy production plants in terms of release of emissions. The proposed Project is not expected to have a significant effect on air quality and any degradation in the existing ambient air quality and airshed.

2.4.3 Wastewater and Ambient Water Quality

The IFC Wastewater and Ambient Water Quality Guidelines are applicable to projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations to the environment and industrial discharges to sanitary sewers that discharge to the environment without any treatment. The guideline provides information on common techniques for wastewater management, water conservation, and reuse that can be applied to a wide range of industry sectors. According to the guidelines the projects with the potential to generate process wastewater, sanitary (domestic) sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment.

In accordance with the guidelines, the septic systems should be properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater, well maintained to allow effective operation, installed in areas with sufficient soil percolation for the design wastewater loading rate, installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

The guidelines also state that if sewage from the industrial facility is to be discharged to a septic system, treatment to meet applicable national or local standards for sanitary wastewater discharges is required. The wastewater from the septic tank will be transported to a treatment plant where it will be treated to meet the standards in accordance with the guidelines.

2.4.4 Hazardous Materials

The Hazardous Material Management guidelines apply to projects that use, store, or handle any quantity of hazardous materials, defined as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. Hazardous materials can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidizing substances; toxic materials; radioactive material; and corrosive substances.

According to the guidelines the overall objective of hazardous materials management is to avoid or, when avoidance is not feasible, minimize uncontrolled releases of hazardous materials or accidents (including explosion and fire) during their production, handling, storage and use. Projects, which manufacture, handle, use, or store hazardous materials, should establish management programs that are commensurate with the potential risks present. The main objectives of projects involving hazardous materials should be the protection of the workforce and the prevention and control of releases and accidents. These objectives should be addressed by integrating prevention and control measures, management actions, and procedures into day-to-day business activities.

The guidelines also address preventive measures for hazardous materials transfer. It states that uncontrolled releases of hazardous materials may result from small cumulative events, or from more significant equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment. It is recommended to use dedicated fittings, pipes, and hoses

specific to materials in tanks and maintaining procedures to prevent addition of hazardous materials to incorrect tanks, to use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure safe transfer, to regular inspect, maintain and repair of fittings, pipes and hoses, to use secondary containment, drip trays or other overflow and drip containment measures for hazardous materials containers at connection points or other possible overflow points.

There will be a minor amount of hazardous material stored and used during construction and operation of the proposed Project. The Project will comply with the requirements of the Hazardous Materials Management Guidelines.

2.4.5 Waste Management

Waste Management Guidelines apply to projects that generate, store, or handle any quantity of waste across a range of industry sectors. It emphasizes that the facilities should establish a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes, avoid or minimize the generation waste materials as far as practicable, recover or reuse waste where waste generation cannot be avoided, treat, destroy and dispose wastes in an environmentally sound manner where waste can not be recovered or reused.

The guidelines stipulate that the facilities that generate waste should characterize their waste according to composition, source, types of wastes produced, generation rates, or according to local regulatory requirements. It also requires that the processes of the facilities should be designed and operated to prevent, or minimize, the quantities of wastes generated and hazards associated with the wastes generated. It is also essential to implement recycling plans in order to reduce the total amount of waste. If waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed of and all measures should be taken to avoid potential impacts to human health and the environment.

Solid (non-hazardous) Wastes

According to the guidelines solid wastes generally include any garbage, refuse. Examples of such waste include domestic trash and garbage; inert construction / demolition materials; refuse, such as metal scrap and empty containers (except those previously used to contain hazardous materials which should, in principle, be managed as a hazardous waste).

Very small amount of solid waste will be generated throughout the construction and operational phases of the Project. They will be managed with the provisions stated in the guidelines.

Hazardous Wastes

According to the guidelines hazardous wastes share the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes

may also be defined as” hazardous” by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics.

The guidelines state that the hazardous wastes should always be segregated from nonhazardous wastes and its management should focus on the prevention of harm to health, safety, and the environment. It is crucial that the potential impacts and risks associated with hazardous wastes should be completely understood, the hazardous wastes are handled, treated and disposed by reputable and legitimate enterprises licensed by the relevant regulatory agencies and they should be stored so as to prevent or control accidental releases to air, soil and water resources. On-site and off-site transportation of wastes should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. .

3.0 PROJECT DESCRIPTION

3.1 Proposed Project

GARET Enerji Üretim ve Ticaret A.Ş. (GARET) proposes to install Karadağ Wind Power Project (KWPP) with 10 MW installed capacity in İzmir Province of Turkey. The KWPP will have 4 turbines, each having an output of 2.5 MW. Power will be connected via a 13 km transmission line to the existing 154 kV Alosbi Transformer Station. GARET obtained the “Electric Power Generation License” from the Energy Market Regulatory Authority (EMRA) for the proposed Project site. A 49-Year License (License No. EU/1632/6/1194, dated June 5, 2008) is granted for the proposed Project by the opinion of EMRA under the provisions of Law No. 4628 governing the electricity market in the Republic of Turkey.

3.2 Project Objective

Gross electricity consumption of Turkey (Gross electricity generation of Turkey + import/export) has reached 198.1 billion kWh in 2008 with an increase of 4.2% compared to the 2007 level. The net electrical energy consumption in Turkey (internal consumption, network loss and electricity leakage) has been 161.9 billion kWh in 2008 (Turkish Electricity Transmission Company, 2009).

Instantaneous peak demand and energy demand of Turkey interconnected electricity system is presented Table 3-1 (Turkish Electricity Transmission Company, 2009) and in Figure 3-1. In 2007, the peak demand was 29,249 MW and the minimum load was 11,100 MW. In 2008, the peak demand was 30,517 MW and the minimum load was 10,409 MW.

Table 3-1 Interconnected Electricity Power System Peak Power and Energy Demand

Years	Peak Demand (MW)	Increase (%)	Energy Demand (GWh)	Increase (%)
1997	16926	11.1	105,517	11.3
1998	17799	5.2	114,023	8.1
1999	18939	6.4	118,485	3.9
2000	19390	2.4	128,276	8.3
2001	19612	1.1	126,871	-1.1
2002	21006	7.1	132,553	4.5
2003	21729	3.4	141,151	6.5
2004	23485	8.1	150,018	6.3
2005	25714	7.2	160,794	7.2
2006	27594	9.6	174,230	8.3
2007	29249	6.0	190,000	8.8
2008	30,517	4.3	198,085	4.2

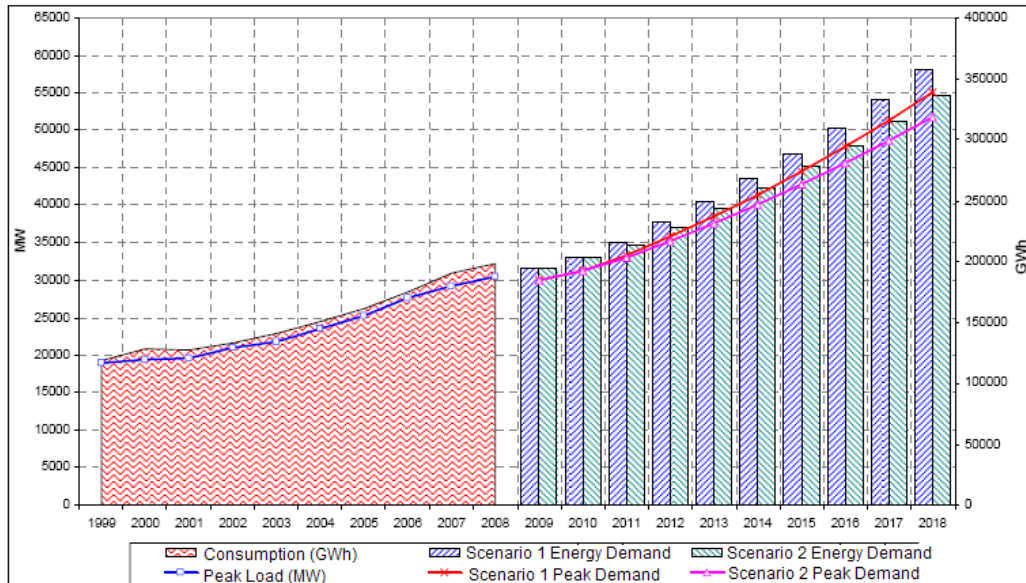


Figure 3-1 Interconnected Electricity Power System Peak Power and Energy Demand

By the end of 2008, the installed power capacity of Turkey was 41,817.2 MW. The total installed wind power capacity is 433.35 MW in Turkey. In addition to this installed power, it was reported that wind farm projects with 402.40 MW capacity is under construction and the total capacity including the projects with a turbine supply contract has reached to 1503.35 MW (TUREB, 2009). According to the Ministry of Energy and Natural Resources (MENR), the potential wind power in Turkey is prescribed to be a total of 8,000 MW of installed capacity for high efficient regime facilities and a total of 40,000 MW of installed capacity for moderately efficient facilities.

The purpose of this Project is to utilize wind energy potential and to compensate energy requirement through a sustainable, environmentally and cost effective way by using wind energy.

3.3 Project Background

Wind speed and frequency are the most important factors to determine the power that can be generated from a wind turbine. GARET installed two meteorological towers/masts at the proposed site in order to evaluate wind energy potential of the region. The wind mast with a 30 m high was installed on December 26, 2006 and meteorological sensors were positioned on this wind mast so as to collect data at 10 m and 30 m above ground. In addition, the wind mast with a 50 m high was installed on August 12, 2007 and meteorological sensors were positioned on this wind mast so as to collect data at 10 m, 30 m, 50 m and 51 m above ground. These two masts are still under operation. The view of masts installed for proposed Project is shown in Figure 3-2. The data acquired from these masts was used to assess the location of the turbines and feasibility of the project together with the direction and frequency of wind, topography of the region and turbine characteristics.

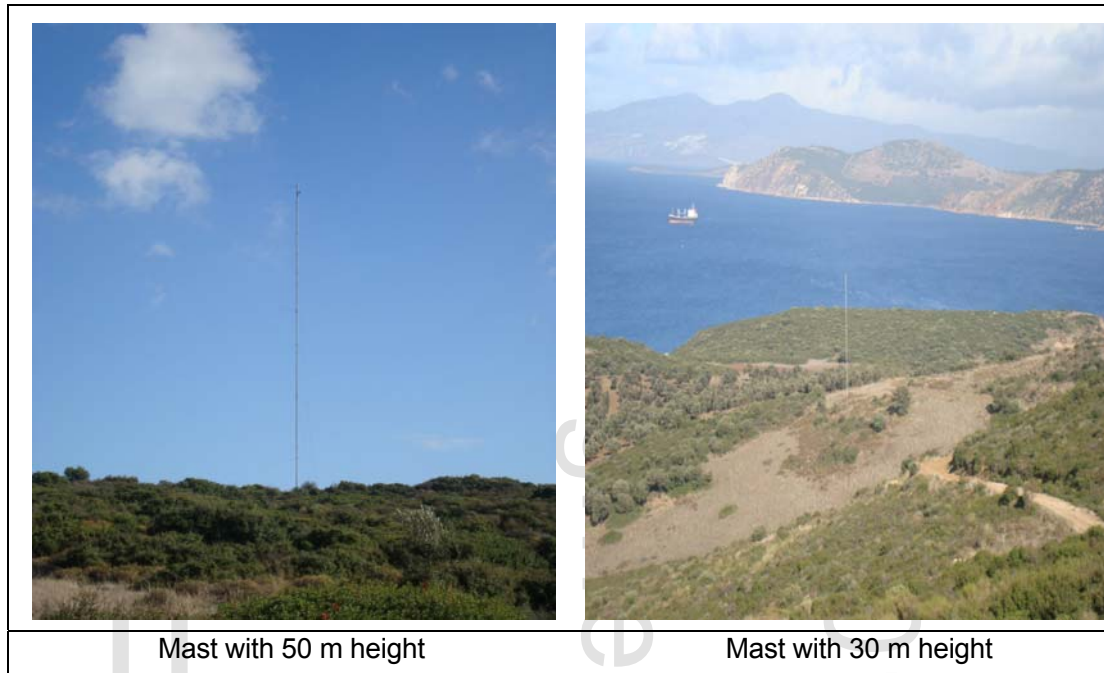


Figure 3-2 View of the Wind Masts within the Project Site

3.4 Project Location

Karadağ Wind Power Plant will be located near Çakmaklı Village located in Aliağa District of İzmir Province. İzmir Province is located to the west of Turkey in the Aegean Region. Aliağa District which is situated in north of İzmir Province has a distance of 45 km to the İzmir Province Center. The Project site located in the southwest of Aliağa District has the approximate distance of 7 km to Aliağa District Center and 42 km to the İzmir Province Center.

The proposed site is located on a hill about 125 m above sea level, shown in Figure 3-7. The land on the proposed Project site is vacant and there are no homes or agricultural fields.

The proposed site is surrounded by industrial zones to the north, northeast, east and southeast. Scrap metal handling facilities, iron and steel facilities, rolling mill facilities, fuel terminals, a fertilizer facility and a natural gas fired combined cycle power plant are located in a close proximity of the proposed Project site. In addition, there are several ports located as shown in Figure 3-3. The closest port is Habaş Port and is located approximately 420 m to the Turbine 1 (T-1). Turkey's largest petrochemical plant (Petkim) and Tüpraş Oil Refinery are located about 3 km and 5.5 km to the proposed site. Industrial facilities and ports in the vicinity of the Project site are discussed in Section 4 and given in Figure 4-6.

The nearest settlements to the Project site are Çakmaklı Village and the summer houses located to the south of the proposed site. The closest turbine to Çakmaklı Village is Turbine 4 (T4) with the distance of about 800 m. Turbine 2 (T2) is the nearest turbine to summer houses situated in the west of the Project site with the distance of about 650 m.

The Project location map is given in Figure 3-3 and the map of turbine locations and access roads of the Project site is given in Figure 3-4. General views of Project site and view of Çakmaklı Village and summer houses are shown in Figure 3-5 and Figure 3-6. Moreover, a site photo log is presented in Appendix A.

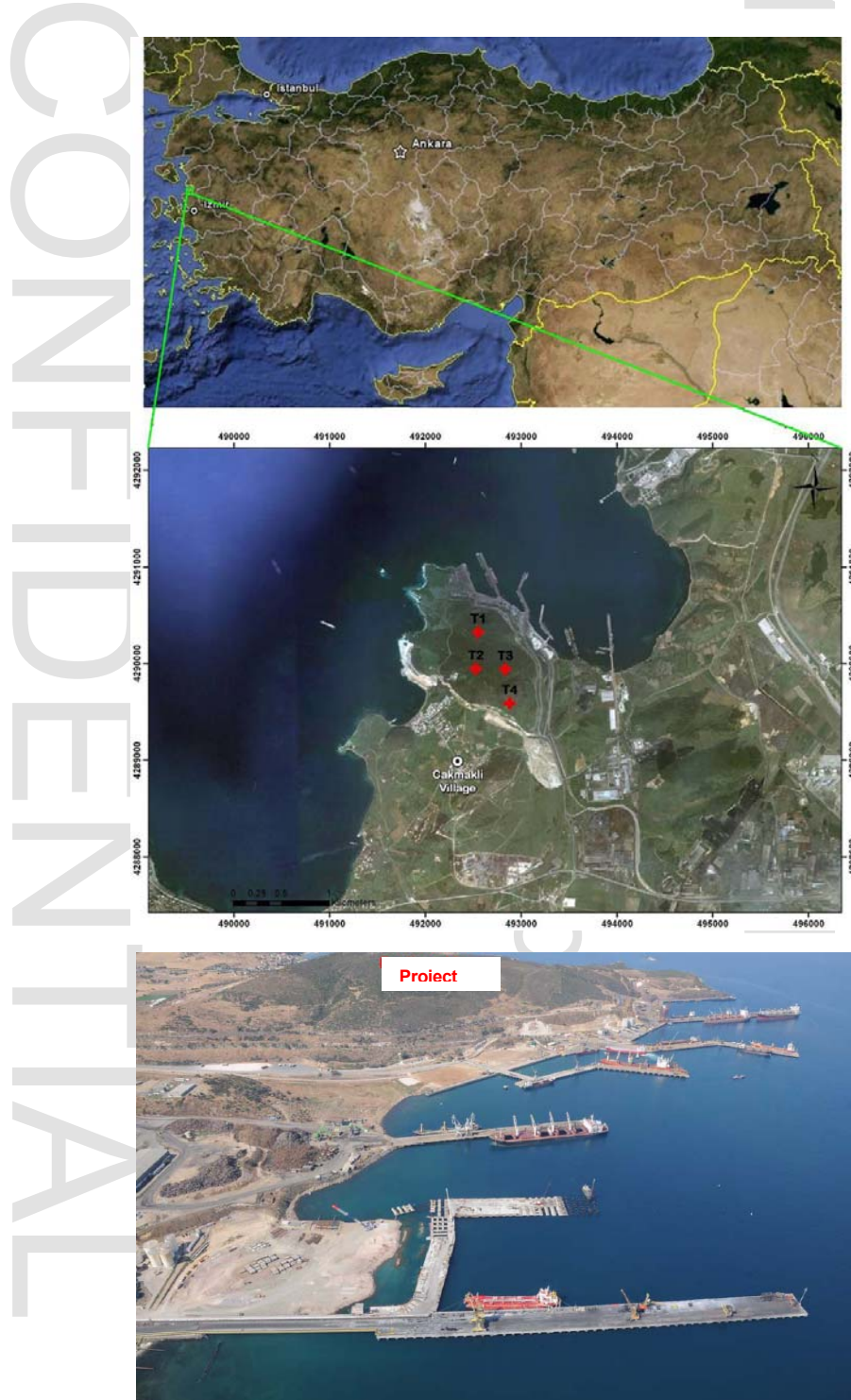


Figure 3-3 Proposed Project Site

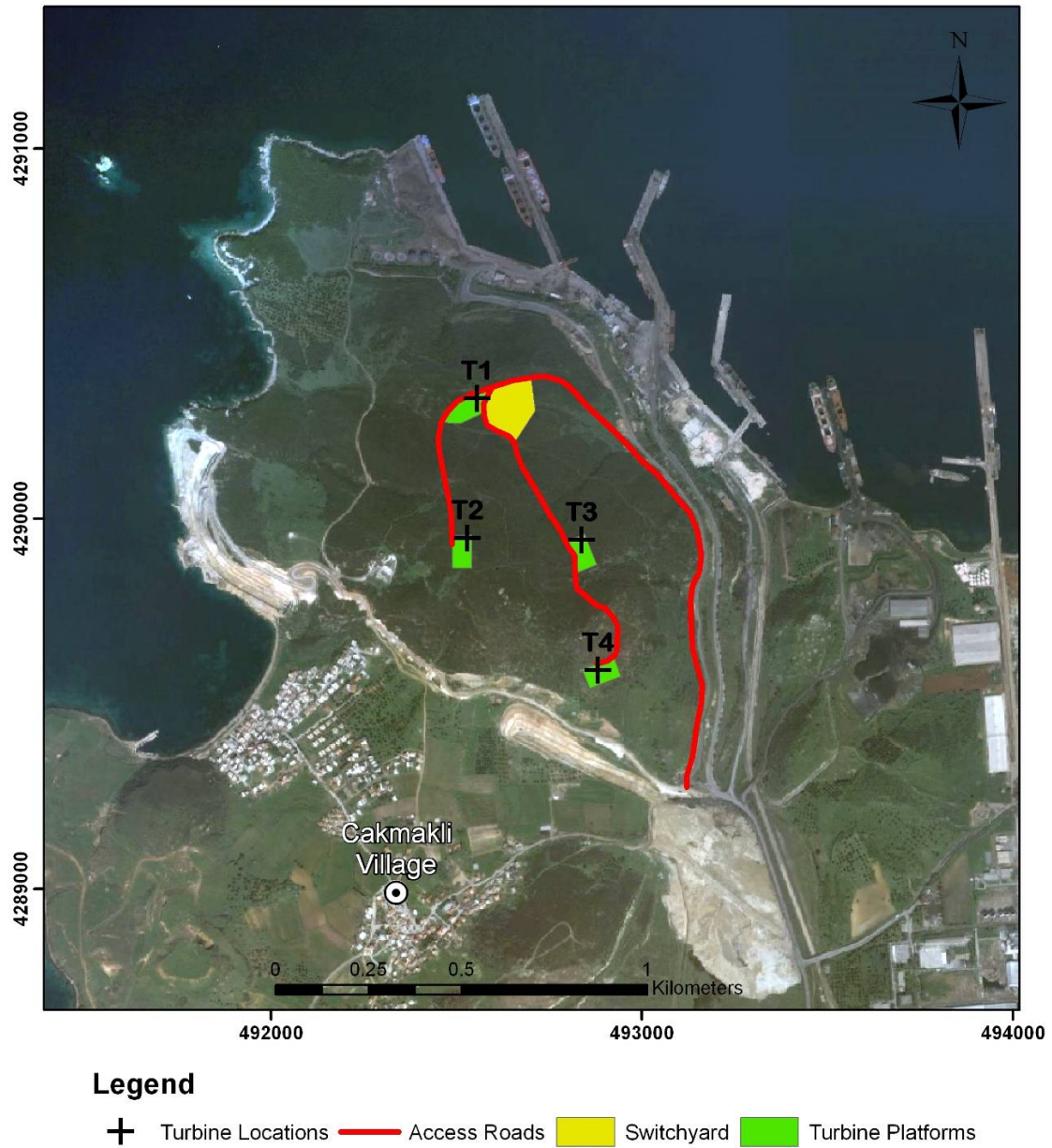


Figure 3-4 Turbine Locations and Access Roads



View of Northern Part of the Project Site Looking North



View of Northeast of the Project Site



View of Southeast of the Project Site

Figure 3-5 Project Site Views



Figure 3-6 View of Çakmaklı Village and Summer Houses

Site Topography

The coordinates (UTM Projection, ED50 Datum) of the turbines are given in Table 3-2 and the locations of the turbines are shown in two and three dimensional topography maps given in Figure 3-7, Figure 3-8 and Figure 3-9, respectively

Table 3-2 Turbine Coordinates

Turbine	Northing (m)	Easting (m)
1	4,290,323.05	492,555.92
2	4,289,946.19	492,529.43
3	4,289,941.00	492,838.35
4	4,289,588.77	492,881.66

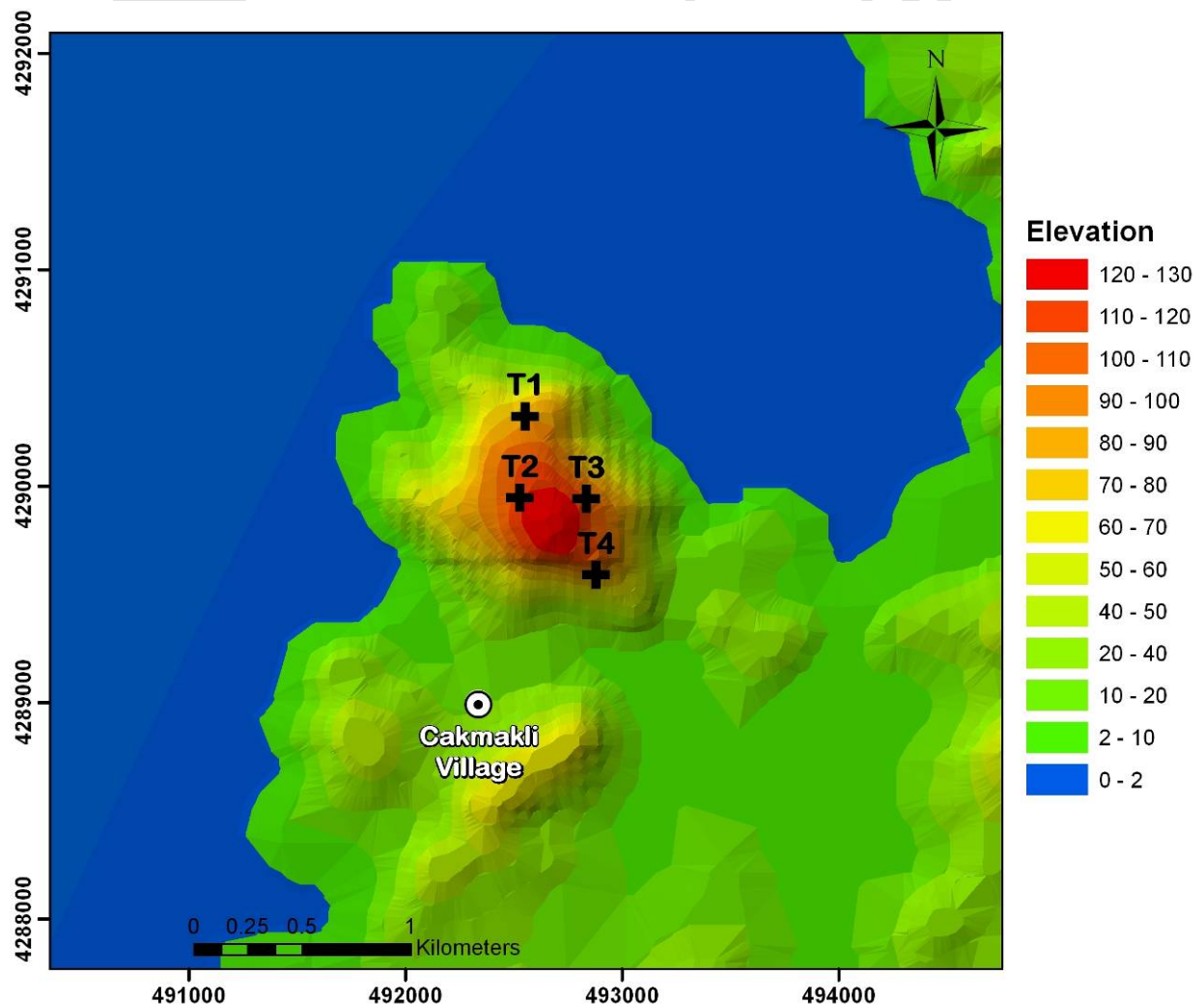


Figure 3-7 Two Dimensional Topography Map

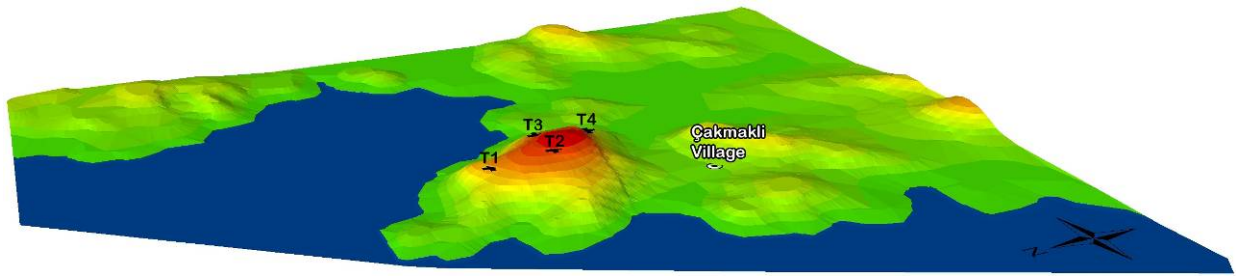


Figure 3-8 Three Dimensional Topography Map Looking Southeast

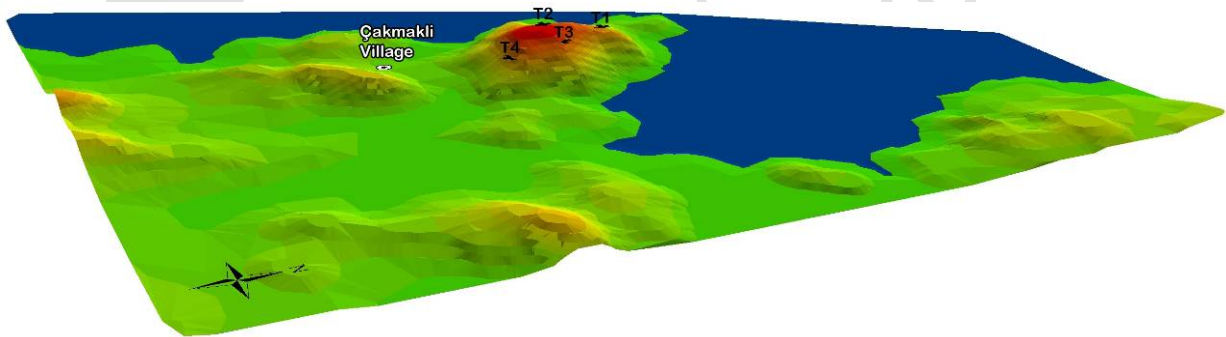


Figure 3-9 Three Dimensional Topography Map Looking Northwest

3.5 Project Technical Characteristics

GE 2.5XL wind turbine with 85 m hub height will be used in the proposed Project. Each turbine will have 2.5 MW rated capacity. The Karadağ Wind Power Project (KWPP) will generate 34.3 GWh electrical energy annually on the average basis with these turbines.

GE 2.5XL wind turbine excels on sites that are constrained by environmental regulations. GE's innovative and patented rotor blade technology provides the 2.5 MW wind turbine with very competitive acoustic performance. In fact, with the optional noise-reduced operation modes, the 2.5 MW wind turbine can be deployed even at sites with the most stringent noise restraints, while simultaneously maintaining a high energy yield. In addition, GE wind turbine will operate at wind velocity of between 3 m/s and 25 m/s. The rotor swept the turbines is 7,854 m² with a rotor diameter of 100 m. Each turbine will have 3 rotor blades. The technical characteristics of the turbine are presented in Table 3-3. The view GE 25XL and the view of the nacelle of the GE 25XL can be seen from Figure 3-10 and Figure 3-11, respectively (GE Energy, 2009).

Table 3-3 Turbine Technical Characteristics

Design Limits	
Rotor Diameter	100 m
Cut-in Wind Speed	3.0 m/s
Cut-out Wind Speed	25 m/s
Rated Power Output	2.5 MW
Minimum ambient temperature operation	-15 °C / -20°C
Maximum ambient temperature operation	+ 40 °C
Minimum Humidity	5 g/m ³
Maximum number of grid-induced disconnections per year	30
Maximum altitude with no deareting	1000 m
Tower	
Type	Tubular Steel Tower
Hub Height	85 m
Yaw System	
Yaw rate	0.5 °/sec
Rotor	
Diameter	100 m
Number of rotor blades	3
Swept area	7854 m ²
Rotor speed range	5-14 min ⁻¹
Rotational Direction	Clockwise looking downwind
Maximum speed of the blade tips	73.6 m/s
Orientation	Upwind
Speed regulation	Pitch-controlled
Aerodynamic brake	Blades in feathering position
Cone angle	3°
Inclination angle of rotor axis	4°
Rotor Blades	
Length (blade root – tip)	48.7 m
Pitch System	
Principle	Single blade pitch control
Main Gearbox	
Rated Power	2750 kW
Type	Multi-stage system
Lubrication	1 mechanical and 1 electrical pump
Brake System	
Primary brake system	Single blade pitch control
Secondary brake system	Single blade pitch control
Holding brake	Hydraulically driven brake caliper on high-speed shaft
Generator	
Type	Permanent magnet generator
Rated output	2640 KW
Rated speed	1650 min ⁻¹
Rated voltage	710 V
Apparent Power	2808 kVA
Frequency at rated output	110 Hz
Protection Class	IP54
Insulation Class	F
Function type	S1
Standard	EN 60034-1
Converter System	
Type	Voltage source converter
Rated voltage, line slide	690 V +/-10 %
Rated frequency	50 Hz / 60 Hz
Protection class of the electronics	IP54



Figure 3-10 View of GE 2.5XL

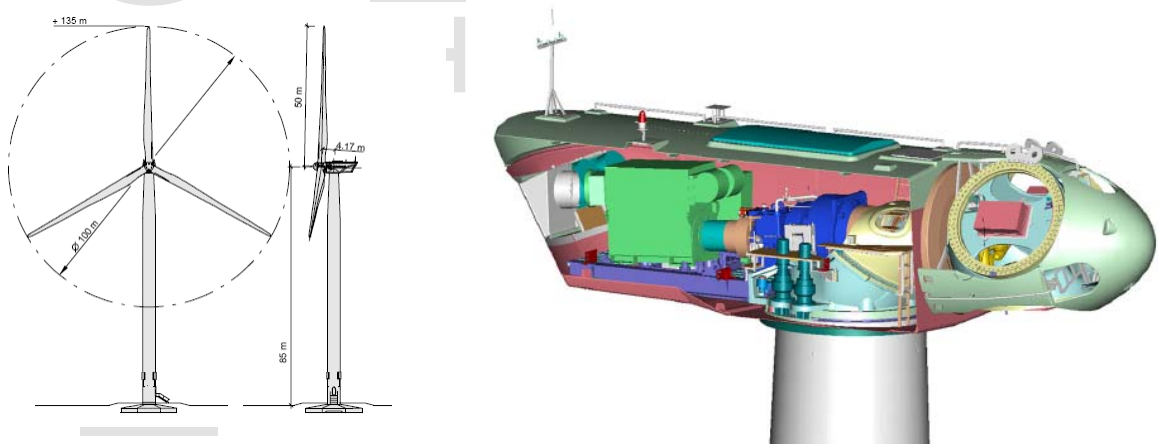


Figure 3-11 View of Nacelle

3.6 Shipment and Access

The turbines for the proposed Project will be purchased from Germany and shipped to the Aliğa Port. Route and Site Assessment Study was conducted in order to determine the transport route, hand-over point, access roads and site roads that that would allow the delivery, storage and transportation of the Units to the project site with a minimum of handling of the components and required construction work.

In the scope of Route and Site Assessment Study, the proposed main route from Aliaga Port to the Facility has been checked. Main Transport Route from the Aliaga Port to Site access of Karadağ Wind Power Plant Project Area is presented in Figure 3-12. Hand-over point is also shown in this Figure. As seen from the figure, an alternative access road was determined in the scope of the study since there is high voltage electricity line crossing the road 35-79 by passing the steel facility. It will be checked whether the height of the electricity line is sufficient for the transportation of the Tower section. If it is not possible, alternative access road will be used.

According to Route and Site Assessment Study, the distance between Aliaga Port and the site access is approximately 15 km and the transit time between Aliaga Port and the Site access is estimated as an hour.



Figure 3-12 Main Transport Route for the Proposed Project

3.7 Project Construction

A total of 4 turbines each having an output of 2.5 MW will be constructed in the scope of the Project. The total installed capacity of the Project will be 10 MW and 34.3 GWh will be generated with 4 turbines. The height of the turbine towers will be 85 m. Approximately 400 m² area will be excavated for each turbine foundation. Turbines, transformers, a switchyard and an administrative building will be placed on this area.

The following works will be performed during the construction of the proposed project:

- Preparation of site, site compound/laydown area;
- Excavation activities for turbine tower foundations and control building pad foundations;
- Site access roads preparation;
- Preparation of crane pads at each wind turbine location;

- Service road construction between turbines;
- Construction of turbine/tower foundations;
- Construction of auxiliary units and control building;
- Transportation and construction of the towers;
- Transportation and assembly of the turbines, rotors and blades;
- Installation of the electricity (underground lines) and control system;
- Connection to the system;
- Commissioning and energizing the plant; and
- Site re-instatement and restoration.

A temporary site compound with a lay down area will be constructed for the parking of construction vehicles and equipment, staff vehicles, and the storage of materials including turbine blades and other components. A temporary office and washroom facilities will also be installed. A crane pad will be constructed at the base of each turbine location.

Once the access roads and site compound are in place, turbine foundation construction will commence. In order to limit disturbance, the site access roads will be constructed first. It is not proposed to borrow pit to obtain materials and no crushing plant will be used on the sites. Construction of the foundation will comprise excavation of the hole using a digger, outer form setting, rebar and bolt cage assembly, casting and finishing concrete, removing the forms, backfilling, compacting and foundation site restoration. Excavation and foundation construction will be conducted in a manner that will minimize the size and duration of the excavated area. On-site excavated materials will be used for backfill as far as is possible. After the concrete foundation construction, the base of the towers will be backfilled according to the project requirements and the mounting platforms will be prepared.

Other remaining works such as tower and turbine installations, construction of substation, operation and management buildings and the transmission lines will be performed in parallel after completing the tower foundations.

Turbine erection will be performed in multiple stages including: erecting the tower (usually in three or four sections for this size), erecting the nacelle, assembling and erecting the rotor, connecting and terminating the internal cables and inspecting and testing the electrical system prior to operation. Towers, blades and turbine will be lifted and installed with a special high crane.

The feeders from wind towers will be connected via 34.5 kV underground cable channels parallel to the access roads, which will be prepared by an excavator and backfilled in compliance with the technical requirements of the project.

3.8 Project Operation and Maintenance

The operation period of the Project is planned to be 49 years. The operation of the wind power plant will be undertaken in accordance with an Environmental Management Plan that will be developed for the Project.

Typically modern wind turbines operate with an availability of 95 to 99% (i.e. the turbines are available to operate for this percentage of the year). Forced outages can occur mainly because of malfunctioning of mechanical or electrical components or computer controls. These are generally due to malfunction of auxiliaries and controls rather than with the heavy rotating machinery. Heavy rotating machineries are routinely inspected during planned maintenance or by condition monitoring.

Following the more frequent and detailed initial turbine inspections and maintenance in the first year of operation, a semi-annual service is usually expected. The actual service periods will be determined after the operations and maintenance (O&M) contract is finalized. The semi-annual inspection and maintenance generally include taking the wind turbine off-line for a day and consist of inspecting and testing safety systems, inspecting wear and tear on components such as seals and bearings, lubricating the mechanical systems, performing electronic diagnostics on the control systems; verifying pre-tension of the mechanical fasteners; gearbox oil change and inspecting the overall structural components of the wind turbines.

The turbines will need to be visited typically once per month for routine visual inspections. As far as is practical, short term routine maintenance procedures will need to be undertaken during periods of little or no wind to minimize the impact on electricity generation. Major maintenance/servicing are planned where practical during the months where low wind speeds are encountered.

In the event of a fault, the modular design of modern wind turbines allows most of the parts to be rapidly replaced, especially in the electrical and control systems.

Electrical equipment such as breakers relays and transformers require annual visual inspections which does not affect availability of the turbines. Basis testing and calibration of this equipment will require a short break in operation.

3.9 Project Decommissioning

The Project life will be 49 years. The main decommissioning activities will comprise of removal of tower, nacelle, blades; reuse/disposal of foundation, tower, nacelle, blades and removal of cable and ancillary structures.

There are several aspects of the decommissioning phase of the project that may have environmental impacts. Decommissioning will take account of the environmental legislation and the technology available at the time. Necessary notices will be given to the environmental authorities in advance of the commencement of the decommissioning work. Any necessary licenses or permits will be acquired prior to the decommissioning activities.

It is probable that most of the plant and equipment will be at the end of its useful operating life and will be obsolete and unsuitable for further use. Thus, it will need to be dismantled for recycling. Decisions on reuse of plant items, recycling of materials or the disposal to waste will be made at the time of decommissioning in the light of the technology then available, environmental and economic considerations and legislation. Unsalvageable material will be disposed of at a licensed landfill. A crane will be required to dismantle the turbines. Soil surface will be restored to its original condition. Disturbed areas will be re-vegetated or made available for any future intended use.

Compared to thermal power plants, wind turbines can be easily and economically decommissioned and removed from site at the end of their economic life and the site returned to its original condition. There will be little or no trace that the wind turbines had been there following decommissioning.

3.10 Work Force

The construction period of the Project will be one year and the operation period of the Project will be 49 years. It is estimated that 46 personnel will be employed during the construction phase of the Project. However not all workers will be on-site at any one time. The peak workforce will be onsite during the busiest construction period when multiple disciplines of contractors complete work simultaneously. Employees will be hired from the surrounding villages as much as possible. Electricians, riggers, crane operators and heavy equipment operators will also be required.

It is estimated that 7 personnel will be employed during the operation phase of the Project. The proposed work force details are given in Table 3-4.

Table 3-4 Work Force Details

	Duty	Number of Personnel
Construction Phase		
1	Engineer	6
2	Technician	5
3	Workers	35
	<i>Total</i>	46
Operational Phase		
1	Engineer	1
2	Administrative Officer	1
3	Operator	3
4	Security	2
	<i>Total</i>	7

4.0 ENVIRONMENTAL AND SOCIAL BASELINE

4.1 General Climatology of the Region

The climate of region shows the properties of Mediterranean climate with low precipitation. In general, Mediterranean climate can be defined with hot and dry summers and warm and rainy winters. However, attitude from the sea level, distance to sea, pressure and mountain belts cause changes on Mediterranean climate. The proposed Project site is located in Aliğa District of İzmir and the distance between the proposed Project site and the coastal line is approximately 100 m.

The meteorological data is obtained from the Aliğa meteorological station which is located at 38.48 latitude and 26.58 longitude. In order to discuss the meteorological elements of the Project site and its close vicinity, long-term meteorological data (1984-1991) recorded in this station is used.

Temperature

According to long-term meteorological data (1984-1991) recorded by the Aliğa meteorological station, the annual average temperature is 16.5°C. As seen from in Figure 4-1, the warmest months are July and August when the average temperature is higher than 25°C whereas the coldest months are December, January and February when the average temperature is lower than 10°C. The maximum and minimum temperatures during the observation period (1984-1991) were recorded as 41°C on July 27, 1987 and -6.2°C on February 21, 1985, respectively.

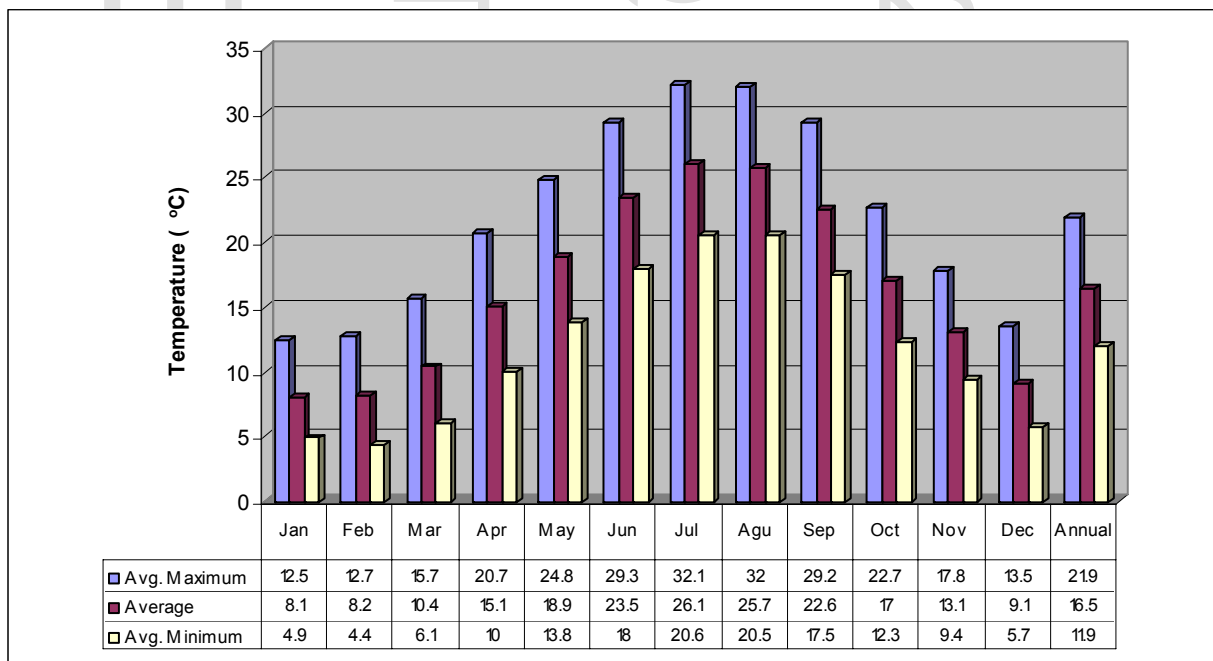


Figure 4-1 Long Term Temperature Data

(Source: Aliğa Meteorological Station (1984-1991))

The minimum ambient temperature for the operation of turbines is given as -15°C / -20°C . In addition, the maximum ambient temperature for the operation of turbines is given as $+40^{\circ}\text{C}$. Since, the average temperature data recorded in the vicinity of the Project site is in the range of operation temperature limits, the Project site is suitable for turbine operation.

Wind

In Aliğa meteorological station, wind data had been recorded in eight section namely; north (N), north-east (NE), east (E), south-east (SE), south (S), south-west (SW), west (W) and north-west (NW). According to measurements conducted at the meteorological station (1984-1991), annual wind speed in the direction of north-east, east and south are more than 4 m/sec. In addition, prevailing annual wind direction is north-east for all seasons and the annual wind speed in this direction is 5 m/sec. The wind rose in Figure 4-2 depicts the annual and seasonal wind directions and intensity recorded at the proposed station.

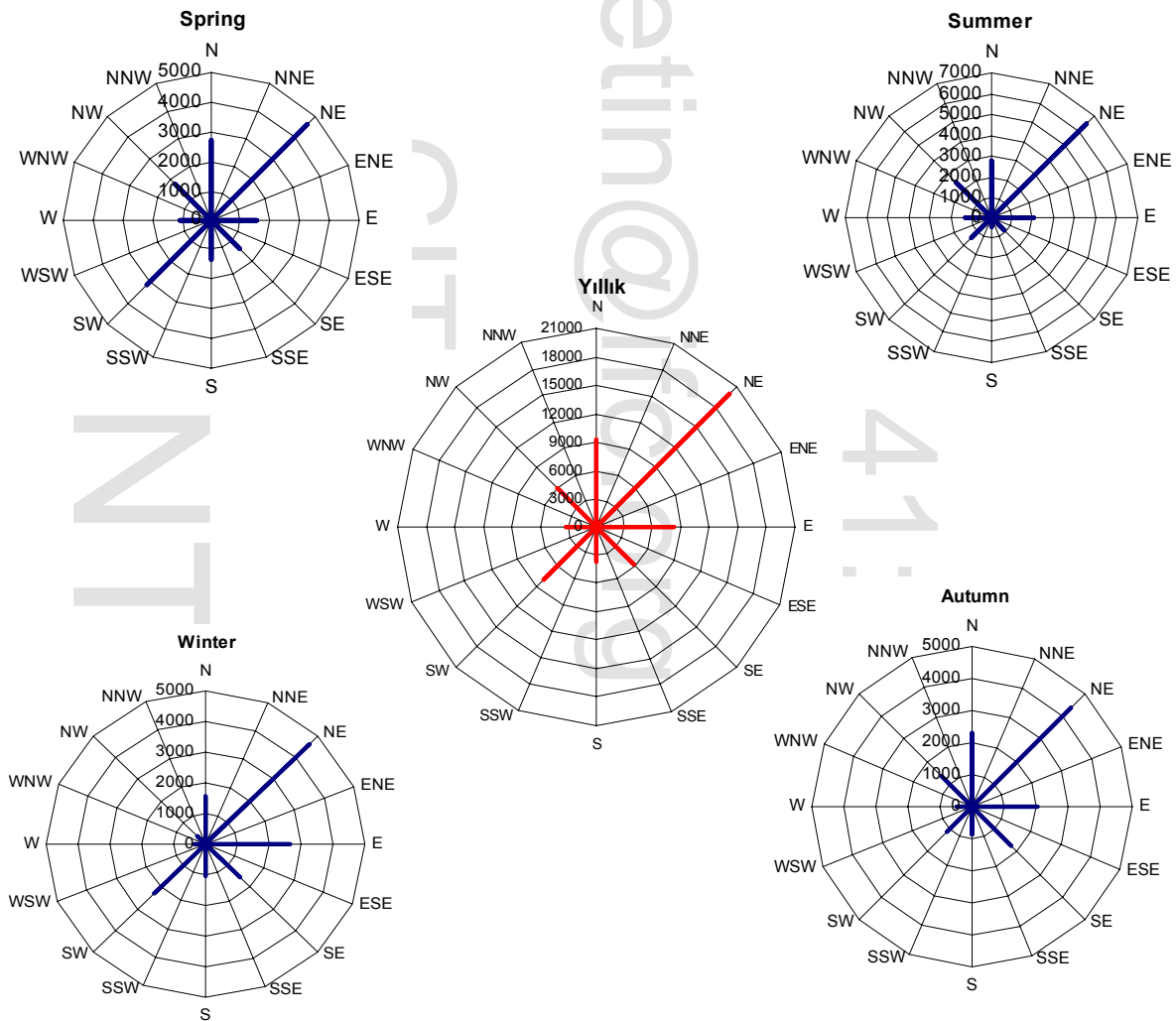


Figure 4-2 Annual and Seasonal Wind Roses

(Source: Aliğa Meteorological Station (1984-1991))

According to Turkish General Directorate of Electrical Power Resources Survey and Development Administration, 7 m/s or more wind speed is required for feasible wind power plant investments. As mentioned in Section 3.3, GARET installed two meteorological towers/masts at the proposed site in order to evaluate wind energy potential of the region. One of two wind masts was installed on December 26, 2006 and meteorological sensors were positioned on this wind mast so as to collect data at 10 m and 30 m above ground. The other one was installed on August 12, 2007 and meteorological sensors were positioned on this wind mast so as to collect data at 10 m, 30 m, 50 m and 51 m above ground. The nominal wind distribution data obtained from the average wind speeds recorded at the sensor located at 50 m during the year of 2008 is presented in Figure 4-3. By using the data tabulated on the figure, it is calculated that approximately 45% of the wind recorded in the project site has equal and greater speed than 7 m/sec and yearly average wind speed is approximately 6.9 m/sec. Hence, the site is found to be a suitable area in terms of wind energy potential

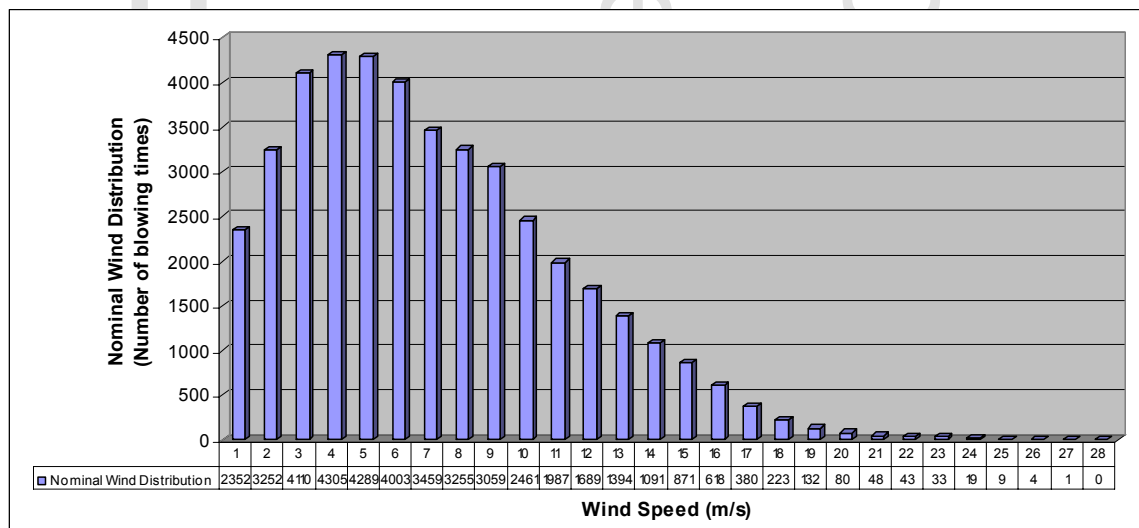


Figure 4-3 Average Nominal Wind Distribution at the Project Site

Precipitation

According to long-term meteorological data recorded at the Aliğa meteorological station, amount of precipitation differs seasonally. Precipitation decreases dramatically in summer season and majority of the precipitation occurs in winter season in general. As seen from Figure 4-4, the rainiest month is December with 75.5 mm monthly average precipitation. On the other hand, the average least precipitation falls in July as 0.1 mm. In addition, according to long-term data, daily maximum precipitation was recorded as 109.4 mm in November.

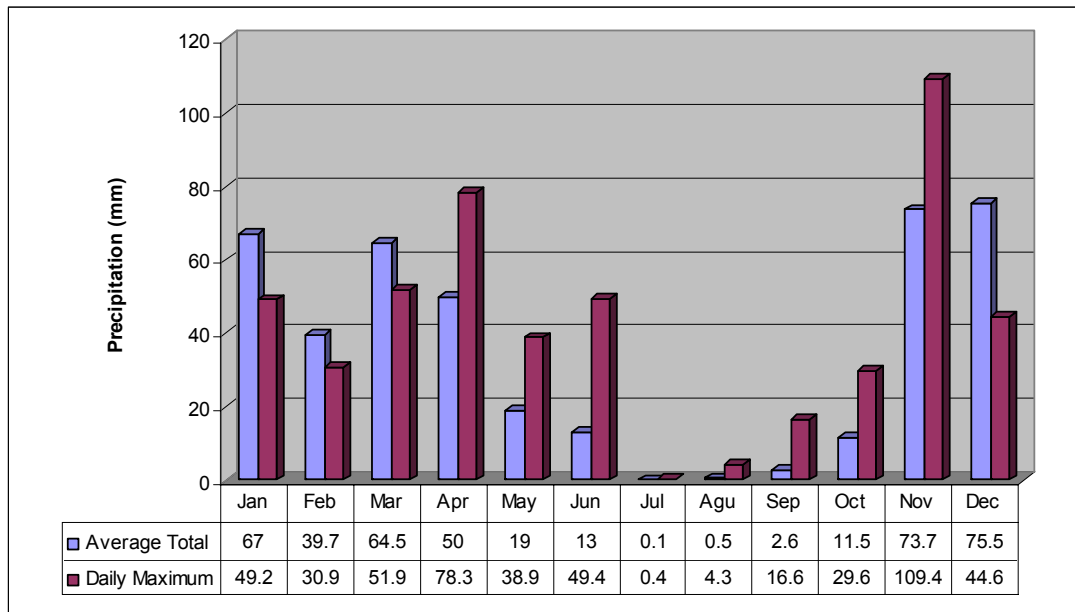


Figure 4-4 Precipitation Data

(Source: Aliğa Meteorological Station (1984-1991))

Humidity

According to long-term meteorological data recorded at the Aliğa meteorological station, average relative humidity is high throughout the whole year. Annual average relative humidity in the region is 60%. In addition, the highest average relative humidity value is observed in January as 69.2% whereas least humid month is July when average relative humidity is 52.9%.

4.2 Air Quality

Air quality is not expected to be an issue in wind power projects. However, a brief background information about the local air quality is provided in this section.

There exist several air quality studies conducted at Aliğa District to monitor the levels of air pollutants and to identify their sources. However, these studies are campaign basis and do not have continuous long term measurement data. Therefore long term air quality data of İzmir Province is assessed in this section. Turkish Statistical Institute keeps air pollution statistics for each province center in Turkey. The statistical data include annual data for PM and SO₂ parameters recorded by the Ministry of Environment and Forestry. There is no air quality measurement station in Aliğa District. The nearest station to the Project site is located in İzmir Central District. General statistical information on the PM and SO₂ are given in Table 4-1 for İzmir in 2008. As seen from the table, annual average SO₂ and PM concentrations are 16 µg/m³ and 58 µg/m³, respectively.

Table 4-1 SO₂ and PM Concentrations Measured in İzmir in 2008

	Pollutant Parameters	
	SO ₂	PM
Number of Days of Measurement	277	304
Annual Average Concentration (µg/m ³)	16	58
Minimum Concentration (µg/m ³)	0	3
Maximum Concentration (µg/m ³)	210	263
Number of days exceeding the Target Limit Value (≥ 500 µg/m ³ for SO ₂ and ≥ 260 µg/m ³ for PM)	0	0
Number of days exceeding the Short-Term Limits (≥370 µg/m ³ for SO ₂ and ≥260 µg/m ³ for PM)	0	0

The Project site is located in the close vicinity of heavy industrial zone. This areas is one of the largest industrial area of Turkey. Dominant industry types in the zone are metal, oil&gas and petrochemical industry. The important emission generating facilities are Petkim Petrochemical Facility located in the north-east of the closest turbine (T-1) with the distance of approximately 3 km, Tüpraş oil refinery with a distance of about 5.5 km and Aliaga Combined Cycle Natural Gas Power Plant located in south-east of the closest turbine (T-4) with the distance of approximately 3 km. The other emission generating industrial facilities located in the close vicinity of the proposed Project site are Ege Fertilizer Facility, Turkuaz Fuel Loading Terminal and İzmir Iron and Steel Facility which are located in south-east of the closest turbine (T-4) with the distances of approximately 1 km, 1.4 km and 1.5 km, respectively. In addition, there are several metal facility and Aliaga Small Scaled Industrial Zone in the vicinity of the Project site.

No air emission will be generated due to operation of the wind power plant. Air emission will be generated temporarily only during the construction phase. Since, the construction period of the Project is approximately one year and the emission will be mainly generated due to operation of the construction vehicles at the site, effect on the air quality will be temporary and expected to be minor.

4.3 Land use and Landownership

General Land use

In order to determine general land use of the Project area and its close vicinity, 1/5,000 scaled Regulatory Development Map, forest data from the website of General Directorate of Forestry, satellite images and site observations are taken into consideration.

In accordance with the 1/5,000 scaled Regulatory Development Map, the Project site is classified as forestry land. A map of the area that is obtained from the GIS website of General Directorate of

Forestry is also reviewed and given in Figure 4-5. The figure provides information on the fertility of the forestry area, density of the forestry area and tree species.

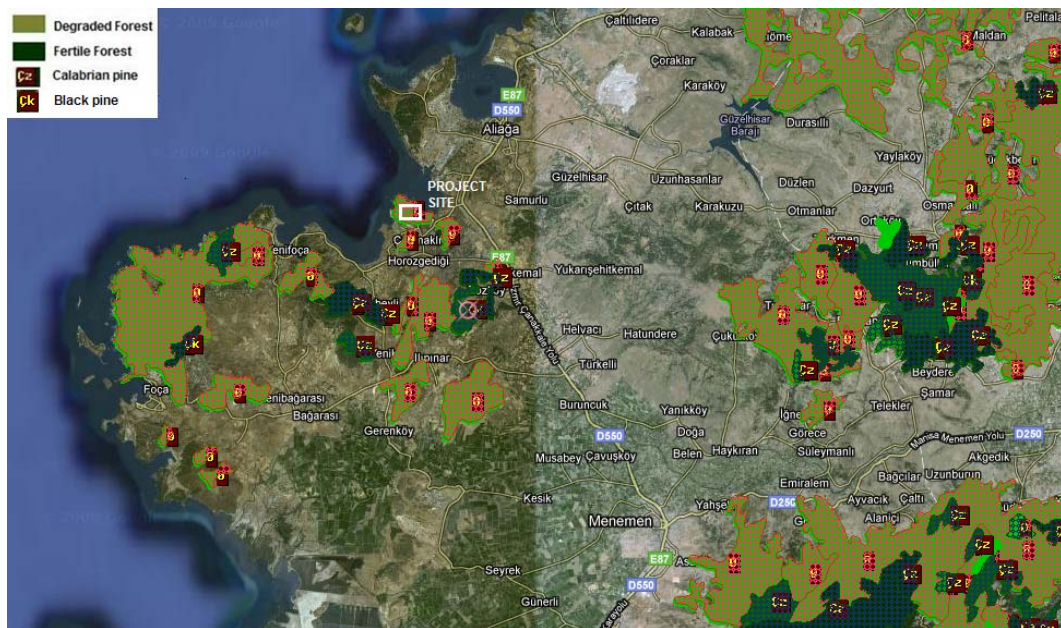


Figure 4-5 Forest Lands around the Project Site

(Source: Geographical Information System of MoEF, 2009)

As seen in Figure 4-5, the Project site is located within the forestry area. Majority of the forestry area located within the Project site and in the close vicinity can be classified as degraded. In addition, the density of the forestry land within the Project site is classified as “zero” which means the area has lowest density degree. Furthermore, dominant tree type in the forestry area located within the Project site is Calabrian Pine.

Since the Project is located on the forest land, related permission for usage of forest land should be secured. GARET will apply to the Ministry of Environment and Forestry for pre-permit. After the preliminary permission, permanent permission will be obtained from the Ministry of Environment and Forestry. The Project area is not used for any purpose of economic income or settlement.

Land Ownership

The Project area is located on a state-owned land. 1/25,000 and 1/5,000 scale Environmental Development Plans of the Project area were revised by including the Karadağ Wind Power Plant and approved by the government.

The Law on the Use of Renewable Energy Resources for the Generation of Electricity numbered 5346 and dated May 10th, 2005 states that if the land required for the turbines, access roads and transmission line of a renewable energy plant (solar, wind, geothermal etc.) is a state-owned land, leasing or giving right of access of the required land to the project owner is conducted by the Ministry of Finance. All of the turbine locations and site access roads are state-owned land.

Industrial Facilities

The Project site is located in the close vicinity of heavy industrial zone. Some of the industrial facilities located in this zone can be listed as iron and steel facilities, rolling mill facilities, fuel terminals, fertilizer facility and natural gas combined cycle power plant. In a close proximity, Turkey's largest petrochemical production complex (Petkim) and an oil refinery (Tüpraş) are located. In addition, there are several ports located in the close vicinity of the proposed site. Industrial facilities and ports in the vicinity of the Project site are given in the Figure 4-6. As seen from the figure, the closest port to the Project site is Habaş Port which is located approximately 420 m to the Turbine 1 (T-1). In addition, as seen from the figure, dominant industry type in the zone is metal industry and the closest industrial facilities to the Project site is İzmir Iron and Steel Facility, Ege Fertilizer Facility and Turkuaz Fuel Loading Terminal. Furthermore, Aliaga Combined Cycle Natural Gas Power Plant is located approximately 3 km southwest to the Project site.



Figure 4-6 Industrial Facilities in the Close Vicinity of the Project Site

AECOM has conducted a Phase I subsoil investigation at the proposed Project site. AECOM did not observe any indication of potential contamination on the proposed site or any illegally dumped contaminated materials during the visual inspection of the site.

4.4 Background Noise Levels

The Project site is located on a hill top and the closest settlement is Çakmaklı Village and summer houses in the west. In order to determine existing ambient noise levels (background noise) at the nearest settlement, background noise monitoring studies are carried out at the closest noise sensitive receptor (NSR).

4.4.1 Noise Sensitive Receptor

The NSR is selected as the closest residential dwelling, where people permanently live, to the turbines. The coordinates (UTM Projection Zone 35, ED-50 Datum) of the NSR and its distance to turbines are given in Tables 4-2 and 4-3, respectively. The NSR location is shown in Figure 4-7.

Table 4-2 UTM Coordinates of Noise Sensitive Receptor

Noise Sensitive Receptor	X (East)	Y (North)
NSR	492,195.83	4,289,592.60

Table 4-3 Distance between Wind Turbines and Noise Sensitive Receptor (m)

	Turbines			
	T1	T2	T3	T4
NSR	814	486	731	686

The selected NSR is situated in the east of summer houses located in the north of Çakmaklı Village. It is the closest permanent residential house to the Project site. There is an asphalt road passing near the house. The closest turbine is Turbine 2 (T2) in a distance of 486 m. There are several buildings in the west and southwest of the NSR, however, there is no building structure, low or mature trees in the direction towards the location of Turbine 2 (T2). The closest building to the NSR is located in 5 m in southwest. The view of the receptor is given in Figure 4-8 below.

4.4.2 Noise Survey

Background noise level monitoring studies were undertaken for two days between November 20, 2009 and November 22, 2009. Ambient noise levels were continuously measured for 48 hours and the levels were logged for ten minute sampling interval. The noise measurements were undertaken with *Type 2 Quest 2900 Integrating/Logging Sound Level Meter*. The equipment used is in compliance with the standards of ANSI S1.4, IEC 651 and IEC 804. The equipment calibration was checked before and after each measurement with an acoustic calibrator which is *Quest QC/10 Calibrator*. The calibrator complies with the standards of ANSI S1.4 and IEC 942. All measurement systems were set to log the L_{min} , L_{max} , L_{Aeq} , L_{A90} noise levels over the required ten minute intervals over the deployment period.

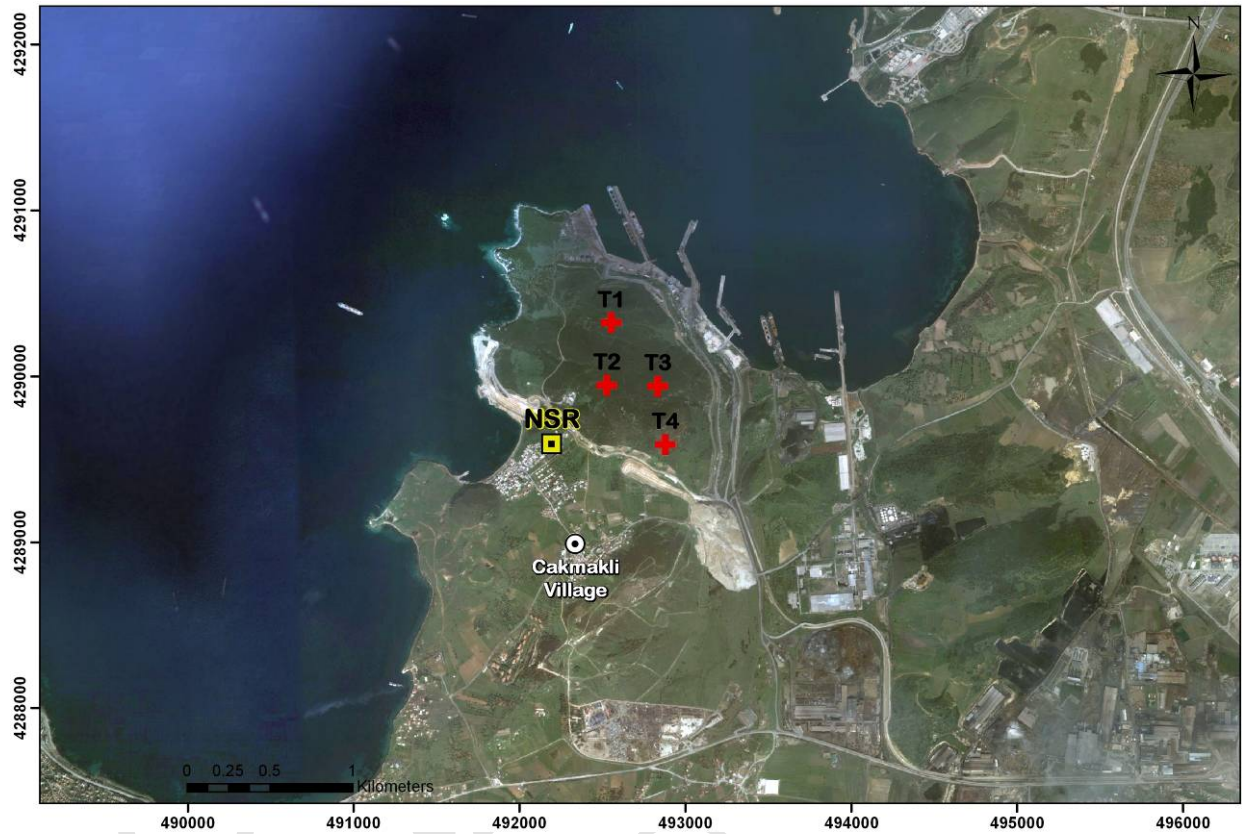


Figure 4-7 Location of Noise Sensitive Receptor



Figure 4-8 View of NSR from the Project Site

The equipment used for the measurements set to a-weighted, fast response, continuously monitoring over ten minute sampling period. All noise measurements were performed with the following precautions;

- Field calibration checked before and after measurements.
- Windshield positioned over the microphone.
- Microphone was positioned approximately 1.5 m above local ground level (on a tripod).
- Microphone placed away from any significant vertical reflective surfaces.
- Monitoring equipment was secured so as to avoid extraneous wind noise generated in close proximity to the microphone.

Concurrent wind speeds and direction and rainfall data were recorded on a free standing approximately 10 m anemometer mast located on the wind farm site. Wind speed and direction data and rainfall data were collected over a similar period, and averaged over the same ten minute periods as the noise data to allow analysis of the measured background noise as a function of wind speed. Background noise level measurement location is shown in Figure 4-9.



Figure 4-9 Noise Level Measurement

4.4.3 Measured Background Noise Levels

The results of the background noise level measurements are compared with respect to both IFC/World Bank Group Environmental, Health and Safety Guidelines – Wind Energy (April 30, 2007) and Turkish Regulation on Assessment and Management of Environmental Noise (RAMEN). Both IFC/WB and RAMEN provides noise limits in Equivalent Sound Level (L_{Aeq}) which is the average A-weighted sound pressure level that gives the same total energy as the varying sound level during the measurement period of time. Since both IFC/WB and RAMEN give the noise limits in L_{Aeq} , the comparisons are made with the L_{Aeq} values measured during the noise survey. However, as

discussed in detail in the impact section, $L_{90,10min}$ descriptor will be used for both the background noise and the wind farm noise (ETSU-R-97, 1997; Rogers, et al, 2006; EPA 2008). The use of the $L_{90,10min}$ descriptor for wind farm noise allows reliable measurements to be made without corruption from relatively loud, transitory noise events from other sources.

4.4.3.1 Comparison with IFC/WB Environmental Noise Guidelines

The IFC/WB noise guideline provides limits for daytime (07:00-22:00) and nighttime (22:00-07:00). Since noise sensitive receptor is located in a residential area in this Project, noise level limits of 55 dBA and 45 dBA are considered for daytime and nighttime guideline L_{Aeq} limits, respectively.

Daytime

The results of the daytime background noise levels are compared with the IFC/WB guideline values. In this regard, the daytime noise measurement results (L_{Aeq}) and IFC/WB guideline value of 55 dBA are plotted in the graphs and given in Figure 4-10 below.

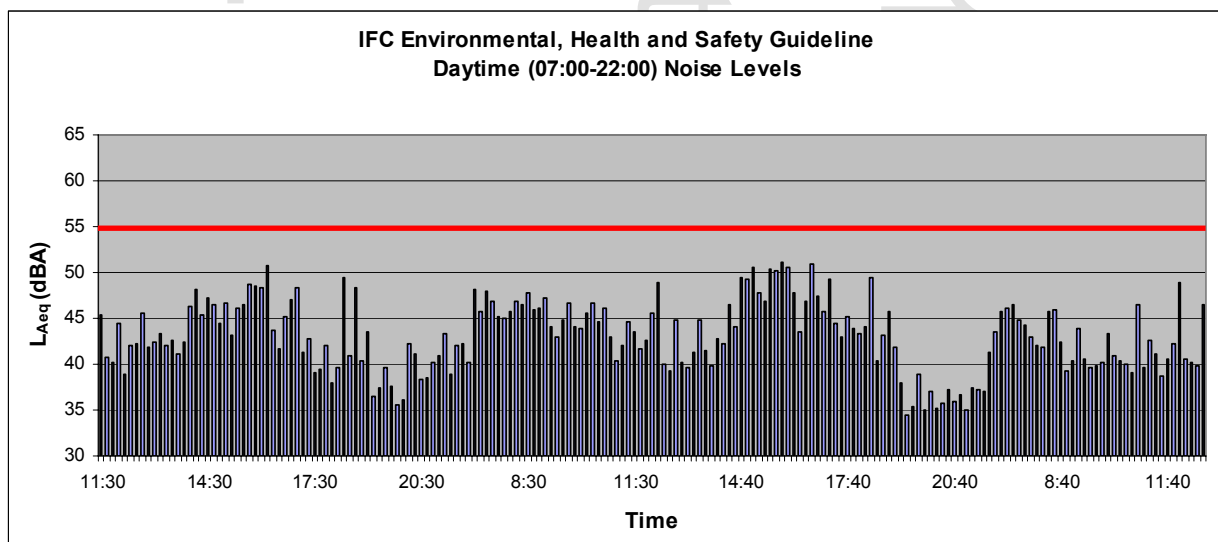


Figure 4-10 Daytime Background Noise Measurement Results compared to IFC/WB Guideline

As can be seen from the graph above, background noise levels at the NSR are below the IFC/WB daytime noise level limit of 55 dBA. Background noise levels measured are between 30 and 50 dBA.

Nighttime

The results of the nighttime background noise levels are compared with the IFC/WB guideline values. The noise measurement results (L_{Aeq}) and IFC/WB guideline value of 45 dBA are plotted and given in Figures 4-11 below.

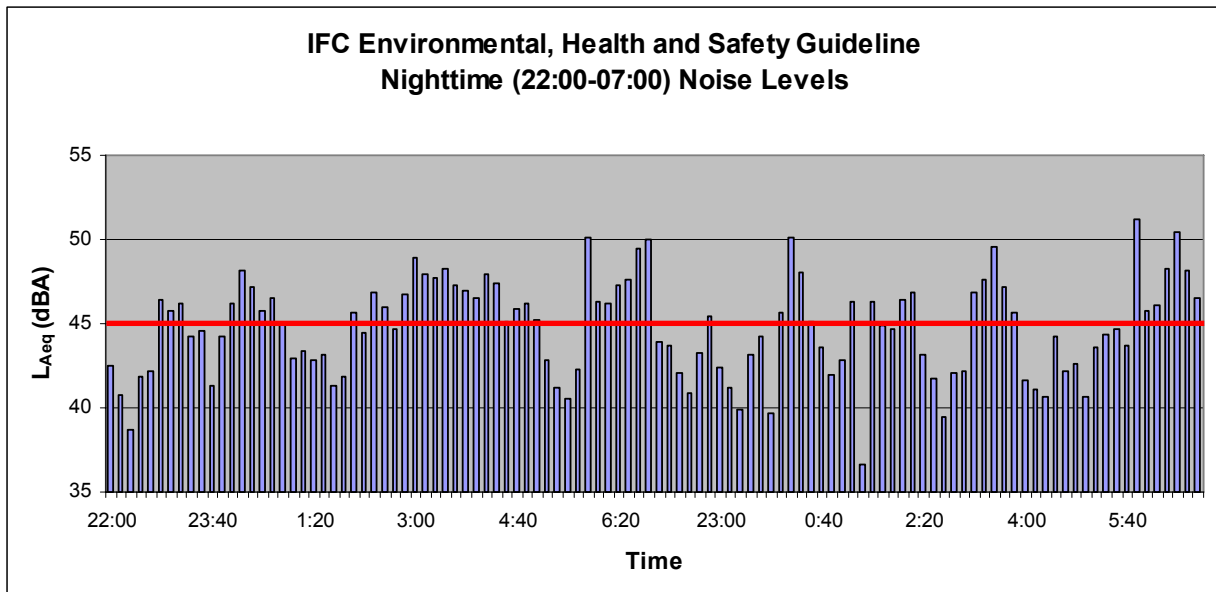


Figure 4-11 Nighttime Background Noise Measurement Results Compared to IFC/WB Guideline

The nighttime measurement results show that background noise levels tend to change with the changing wind speed in the nighttime hours of 22:00 – 07:00. As can be seen in Figure 4-11, half of the measured nighttime background noise levels at NSR do not exceed the IFC/WB limit value of 45 dBA. The background noise levels which exceed the IFC/WB limit of 45 dBA can be explained with the blowing wind at high speeds and industrial activities at close proximity as explained earlier.

4.4.3.2 Comparison with Turkish Noise Limits

RAMEN sets noise limits for daytime (07:00-19:00), evening time (19:00-23:00) and nighttime (23:00-07:00). Since the Project site is located in an area surrounded by dense industrial activities in the close vicinity, it is classified as “Areas with both noise sensitive areas and industrial activities (predominantly industrial)” according to RAMEN, and thus, the L_{Aeq} noise level limits of 68 dBA, 63 dBA and 58 dBA are considered for daytime, evening time and nighttime periods, respectively.

Daytime

The weekday and weekend daytime noise measurement results (L_{Aeq}) and RAMEN limit of 68 dBA are plotted in the graphs and given in Figure 4-12 below. As can be seen in Figure 4-12, all daytime background noise levels at the NSR are well below the RAMEN limit of 68 dBA.

Evening time

The results of the evening time background noise measurements are compared with the Turkish RAMEN. The evening noise measurement results (L_{Aeq}) and RAMEN limit of 63 dBA are plotted and given in Figure 4-13 below.

Background noise level measurements performed between 19:00 and 23:00 at NSR show that evening time background noise levels at the receptor are below the RAMEN evening time limit of 63 dBA.

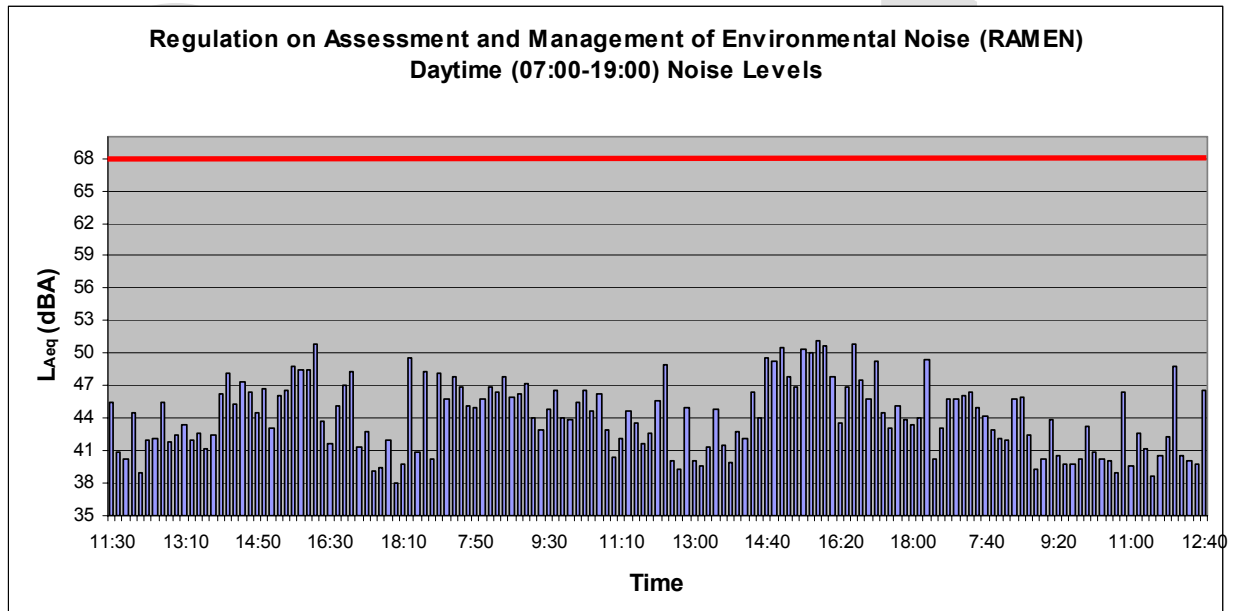


Figure 4-12 Daytime Background Noise Measurement Results compared to Turkish RAMEN

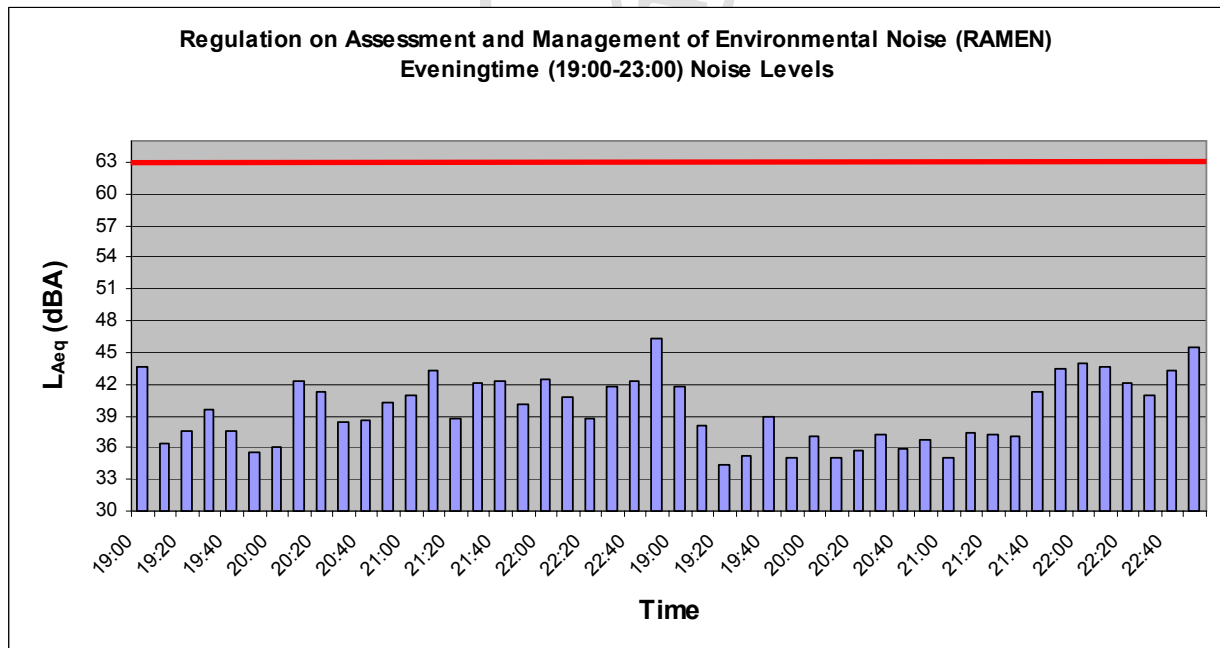


Figure 4-13 Eveningtime Background Noise Measurement Results compared to Turkish RAMEN

Nighttime

The results of the nighttime background noise measurements are compared with the Turkish RAMEN. The night noise measurement results (L_{Aeq}) and RAMEN limit of 58 dBA are plotted and given in Figure 4-14 below.

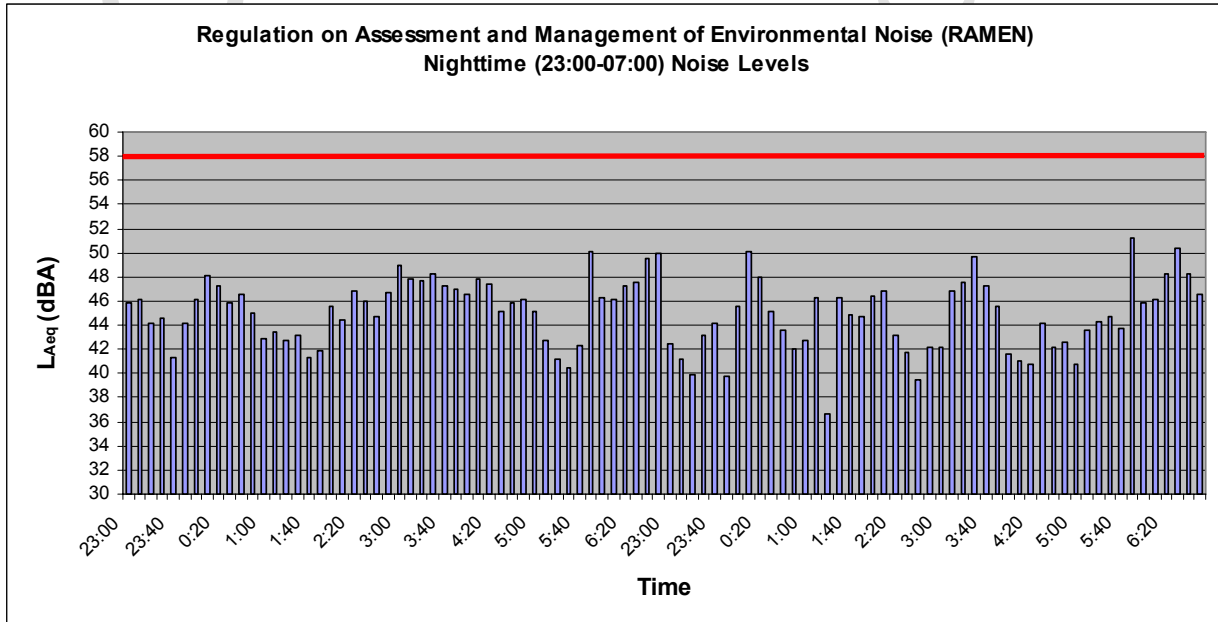


Figure 4-14 Nighttime Background Noise Measurement Results compared to Turkish RAMEN

Background noise level measurements performed between 23:00 and 07:00 at the NSR shows that all nighttime background noise levels at the receptor are below the RAMEN nighttime limit of 58 dBA as in the case of daytime and evening time measurements.

4.4.4 Relationship between Wind Speed and Background Noise Level

In the absence of noise emitting activities, wind blowing at high speeds is the dominant parameter affecting the background noise levels in rural areas. In order to understand the effect of wind speed on background noise levels, 48-hr continuous wind direction and wind speed measurements at 10 m height above ground level were performed simultaneously with the noise level measurements. The wind rose according to the 48-hr wind measurement is given in Figure 4-15 below.

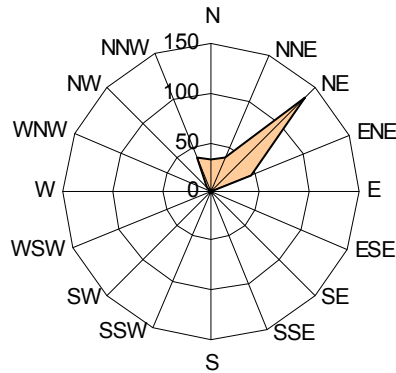


Figure 4-15 Wind Rose of Noise Measurement Results

The wind rose given above show that prevailing wind direction was northeast (NE) during the 48-hr wind measurement period. Wind was blown 135 times from NE and 45 times from ENE. In order to understand whether results of the 48-hr wind measurement represent seasonal, annual or long term wind pattern at the Project site, wind data measured by on site Wind Mast was acquired. Wind rose was drawn from the data of wind mast measured between January and December 2008 and given in Figure 4-16 below.

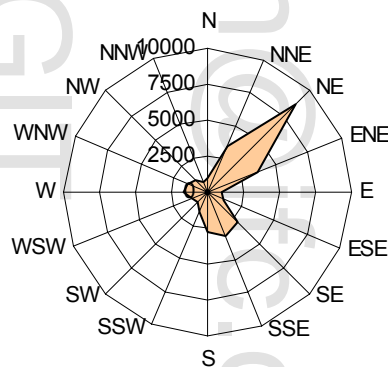


Figure 4-16 Wind Rose Drawn From 6 Months Wind Measurement Results of MAST Tower

As can be seen from the figure above, the 48-hr wind measurement results show similar wind direction characteristics with the 12-month MAST Tower wind measurement results. The prevailing wind direction in both wind roses is northeast (NE). As can be seen in Figure 4-2, the prevailing wind direction shown in spring, summer and annual wind roses drawn from long term wind data obtained from Aliağa Meteorological Station is northeast (NE) which confirms that results of the 48-hr wind measurement show similar characteristics with the wind mast measurement results and the long term wind data of Aliağa Meteorological Station.

4.5 Geology

The proposed Project site is located on Karadağ crest in Karacadoğan cape (which is encompassed by Nemrut gulf and Horozgediği bay) in Çakmaklı district of Aliağa İzmir. The complex geology of the region is due to various geological stages of the Paleotectonic and the Neotectonic. The Paleotectonic comprises the era from the Cretaceous to Epi-Miocene. The most significant process pertaining to this period are the collision of the Sakarya plate and the Anatolite-Tauride plate in the south, and formation of İzmir-Ankara-Erzincan suture zone.

The Neotectonic involves periods in which the horst-graben systems are formed as the most important geological structures of western Anatolia. These periods can be divided into four. In the first period; grabens with N-S orientation are formed due to the contractions developed in E-W orientation in the course of Early-Miocene. The calc-alkaline and hybrid lava activities are peculiar to this era. In the Upper Miocene aged second period; the formation of grabens with E-W orientation due to the contractions developed in N-S orientation occur with the alkaline basaltic lava effusion. In the course of third period, the N-S oriented progression stops and large scale propagation no longer occurs. In the last period, the N-S oriented progression revives resulting in the development of a regional discordance platform in the Neogene formations.

The Gediz fan is formed in the Aegean sea due to the development of E-W oriented Gediz graben like Büyük Menderes, Küçük Menderes and Edremit grabens. The lithological units that constitute the geological structure of the proposed Project site pertain to the Gediz graben. These lithological units are given in Figure 4-17.

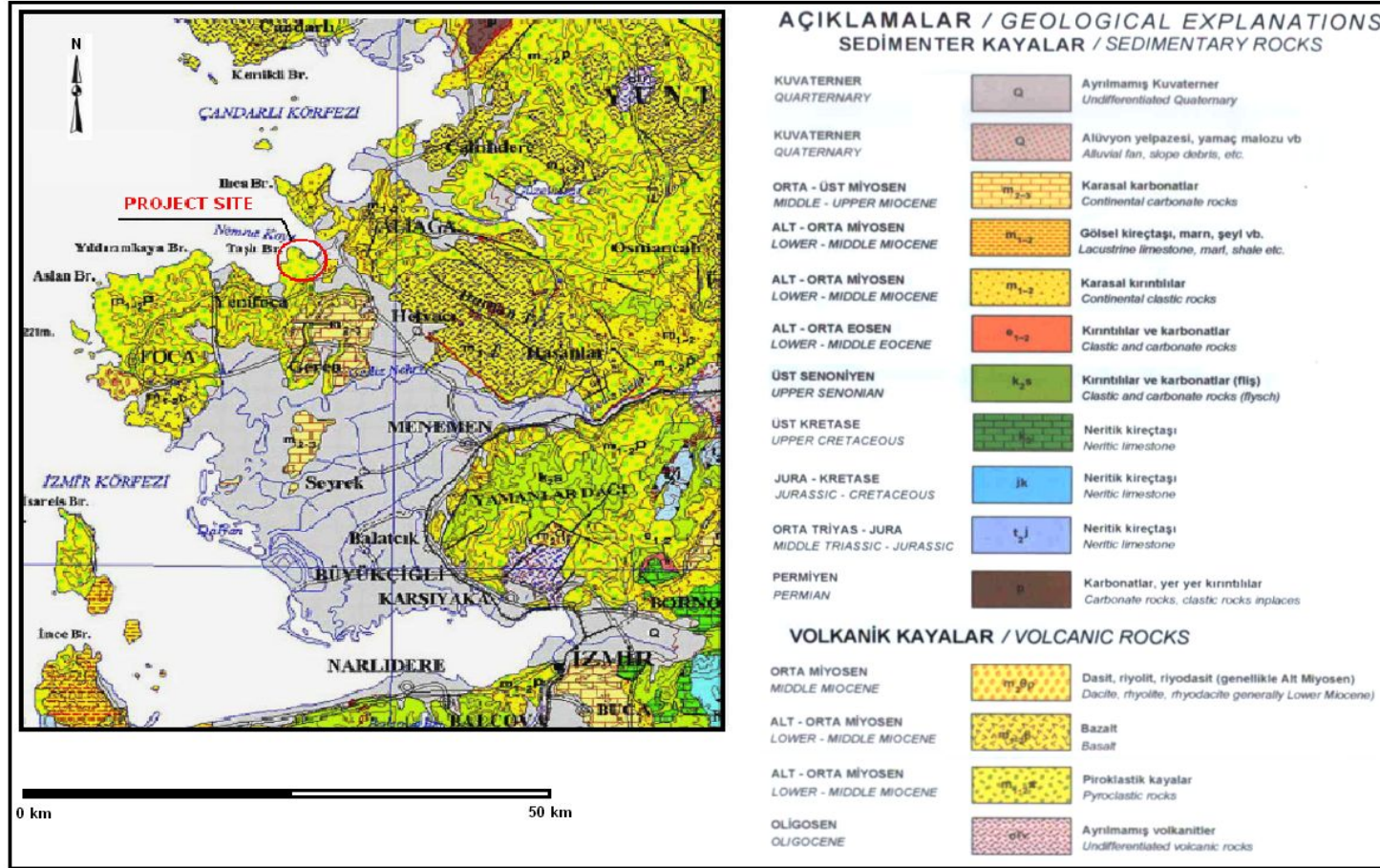


Figure 4-17 The Regional Geological Map of the Project Site

(Source: Modified from the 1/500000 scale Geological Map of İzmir)

Regional Geology

Stratigraphy

Researches on the geology of the region where the proposed Project site is located, has been conducted by MTA. The studies of Eşder T., et. al. (1991) are referred in this text as well as the 1/500.000 and 1/100.000 geological maps which are also prepared by MTA.

The oldest units within the region are allochthonous Upper Cretaceous Flysch of İzmir. This unit is comprised of epiclastic schist that pertain to the greenschist facies with recrystallized limestone boulders and meta-sandstone succession.

Soma Formation: Soma formation overlies the İzmir Flysch with unconformity. It can be observed in large outcrops uninterruptedly. At the bottom, Soma formation is comprised of yellowish, beige, gray colored clayey limestone, marl, mudstone, sandstone, siltstone, fine limestone and tuff successions with robust beddings. In the upper layers, tuff and volcanoclastics prevail. According to these findings, the Lower Miocene lacustrine facies turns into volcano-sedimentary basin. Soma formation is overlain by Aliağa pyroclastic rocks with unconformity.

Aliağa Pyroclastic Rocks: In the course of Mid-Miocene, the region had continental characteristics with occasionally situated shallow waters. During this period andesitic lava and pyroclastic activities occurred. These pyroclastic rocks are called “Aliağa Pyroclastic Rocks”. The tuff within the unit bear volcanic components. The predominant lithology within the proposed Project site are formed of pyroclastic rocks. According to the petrographic examinations of these pyroclastic rocks were defined as; extrusive rocks, acidic tuff, silicified tuff, decomposed tuff and altered pyroclastic rocks. In some levels of Aliağa Pyroclastic rocks, rocks pertaining to lava flow activities also observed like; pyroxene andesite and perlite.

Çamdağ Limestone: Çamdağ limestone form the Middle Miocene aged sedimentary unit that lies in between Lower Miocene Soma formation and Upper Miocene volcanic rocks. The limestones are observed as outcrops in high lands, in the close vicinity of Bozköy. The limestones are gray, beige in color, and are formed of thick layers. Although this unit is fossiliferous, there are no fossils found to be utilized for dating.

Aliağa Volcanic Rocks: All the volcanic rocks that are apart from Middle Miocene Aliağa pyroclastic rocks are named as “Aliağa Volcanic Rocks”. These volcanic rocks which are claimed to be of Upper Miocene age, are of sialic origin and present calc-alkaline characteristics. These volcanic rocks have been divided into five sub-divisions as; Hatundere Dacites; Sarıkaya Riolites, Bozdivlit Basaltic Andesites, agglomerates, Dumanlıdağ andesites.

Hatundere Dacites: The dacite outcrops are observed dark gray, blackish and occasionally brown in color. They are harder than the andesites that they underlie and influences of hydrothermal alteration is observed upon them. These rocks which pertain to lava activities of various orientations have a large extent. The erosion on these rocks proves an interruption of the volcanic activities.

Sarıkaya Riolites: They are observed on tectonic sutures as robust lava flow and dykes with NE-SW orientation. They are maroon and brown in color, occasionally presenting a very hard rock and massive structure. The average thickness of this unit is estimated to be 100 m.

Bozdivlit Basaltic Andesites: They differ from the volcanic rocks they appear with in terms of petrographical, chemical and morphological means. They look alike with the black cooling columns and basalts. The estimated thickness of this unit is 125-150 m.

Agglomerates: Agglomerates appear as the product of the lava explosions phase that occurred prior to the effusion of lava over Bozdivlit basaltic andesitic rocks. They are generally observed as angular gravels cemented within tuff reaching up to boulder size.

Dumanlıdağ Andesites: These rocks are originated from lava flow that are concerned with the faults and fractures that are due to the tectonic activities within the region. These rocks are trachy-andesite, and andesite. Since they are more resistant against weathering, they persist as higher grounds with respect to their surrounding. Dumanlıdağ andesites intrude Aliğa pyroclastic rocks, Bozdivlit basaltic andesites and Hatundere dacites as robust lava layers.

Alluvium: The formation of alluvium still proceeds in the region. Therefore alluvium units pertain to the Quaternary. These formations are recent alluvium that are settled in valley plains, alluvial fans and slope debris. The alluvial fans are mainly comprised of gravel and boulders of volcanic origin and the slope debris are observed as volcanic blocks settled around volcanic elevations.

The geological units that are in the close vicinity of the Project area are given in Figure 4-18.

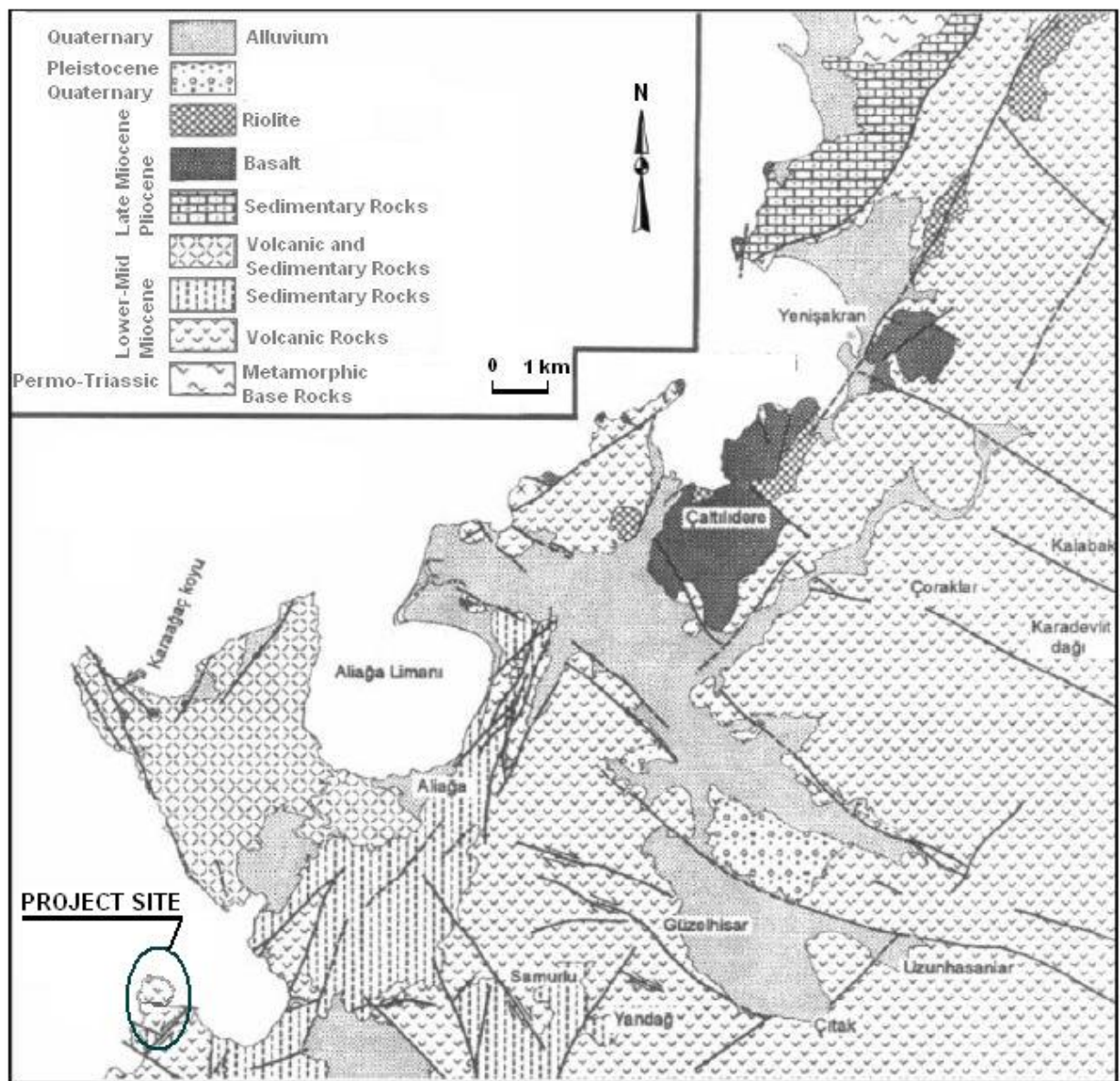


Figure 4-18 Regional Geological Map of Proposed Project Site

4.6 Tectonics and Structural Geology

The region in between Gökova and Edremit, is located in the most active part of the region in which the extensional tectonic regime is dominant. The region is characterized by a group of approximately east-west trending, sub-parallel, normal fault zones bordering a set of grabens and intervening horst blocks. Seismic activity is intense, and dominant motion on the faults is in north-south direction. There are about ten graben systems in Western Anatolia, which are orientated approximately in east-directions (Yılmaz, 2000). The best known grabens which are close to the Project site are Bakırçay (Bergama) Graben, Gediz Graben, Küçük Menderes Graben, Soma Graben, Alaşehir Graben, Simav Graben are shown in Figure 4-19.

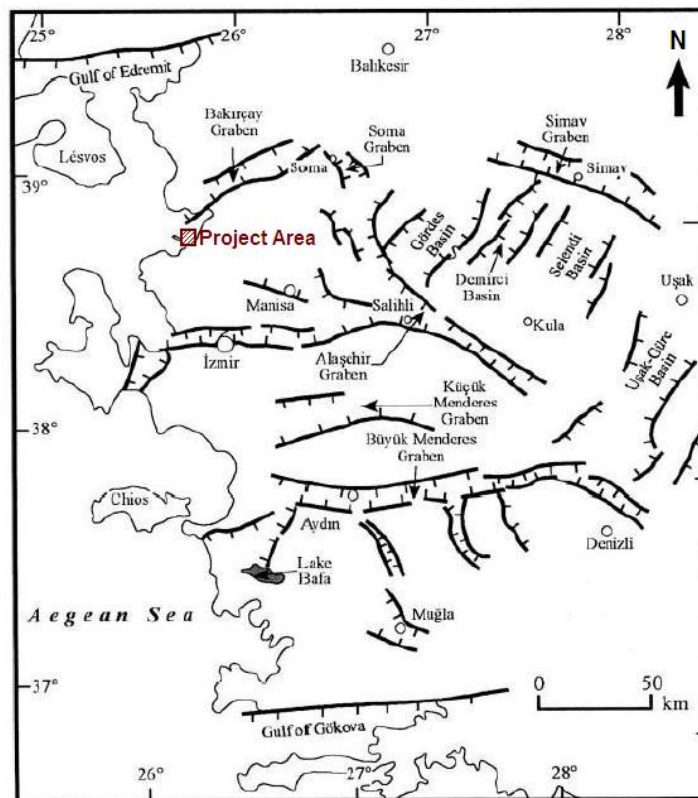


Figure 4-19 Distribution of Grabens in the Region

(Source: Modified from MTA, 2005)

The Bakırçay (Bergama) Graben

The Bakırçay Graben has an elongation of 60 km and 5 km width, is one of the major east-west grabens of Western Anatolia. The Bakırçay River flows west along the valley floor. The Graben has an asymmetric topography, being steeper along the northern part of the valley, where Kozak Magmatics rise steeply. The faults along both sides of the graben, around the Bergama area, indicate mainly normal faulting. The fault pattern is compatible with a north-south extensional regime. The major faults along the northern side of the graben dip steeply with angles around 70° to the south. The main active faults place young alluvial deposits against the older Miocene succession.

The Gediz Graben

The Gediz Graben is located in the central part of western Anatolia where one of the major east-west trending grabens are present. The Gediz Graben elongates 140 km and it is 10-15 km wide, and forms an arc shaped structural pattern; the graben trends approximately east-west. The graben faults are described in considerable detail by Patton (1992), Cohen (1995), and Yılmaz (1999). The graben is asymmetrical, with the southern margin steeper and seismically more active. Along the southern margin rises the steep northern flank of Bozdağ Mountain, bounded by a major fault zone consisting of a number of steeply (>70°) north dipping normal faults, one of which moved during a major earthquake occurred near Alaşehir in 1969. The major fault is also observed throughout the whole extension of the graben.

Three probable active faults are located in the close vicinity of the proposed wind turbines. These are, Güzelhisar Fault, Menemen Fault and Yenifoça Fault (MTA, 2005).

The Güzelhisar Fault

The Güzelhisar Fault is a type of right lateral strike-slip fault, which is 25 km long in northwest-southeast trending. Many earthquakes with a high magnitude had occurred in this zone in the Quaternary period.

The Menemen Fault

The Menemen Fault, which is 15 km long, is characterized by a group of northwest-southeast trending right lateral strike-slip faults having different lengths (5 – 12 km).

The Yenifoça Fault

The Yenifoça Fault, which passes through the Project area, is a type of strike-slip fault along with north-south direction. Yenifoça Fault lies between the north and south direction with a length of 20 km. Figure 4-20 shows the main probable active fault zones around the proposed wind turbines.

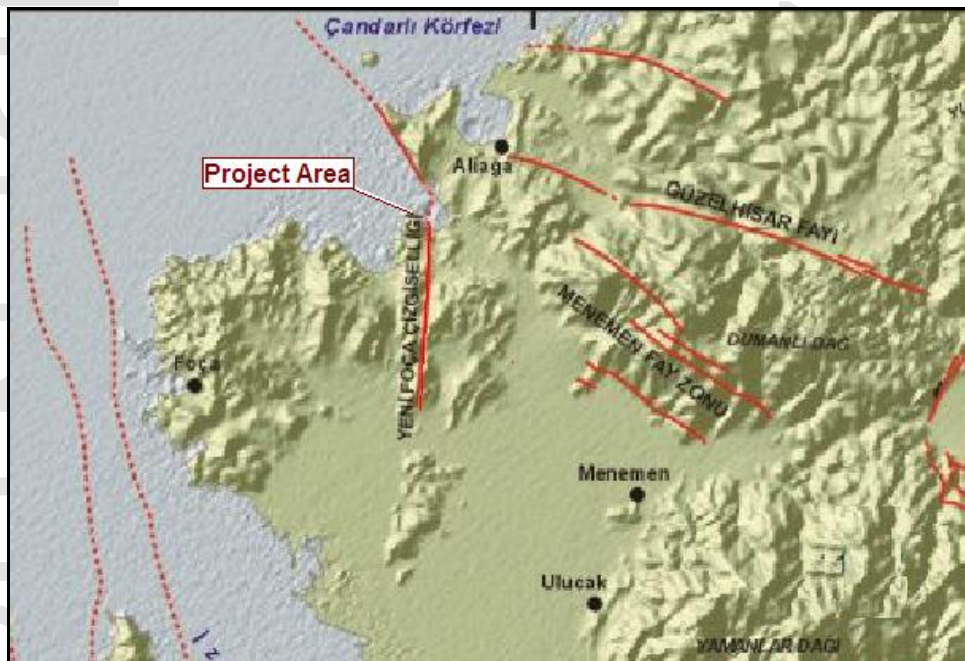


Figure 4-20 Main Active Faults around The Project Area

(Modified from MTA, 2005)

4.6.1 Seismicity

İzmir City and therefore the Project site are located in the 1st Degree Seismic Zone according to the earthquake zones determined by the General Directorate of Disaster Affairs (GDDA) (Figure 4-21). Project site can be considered tectonically very active. There are a significant amount of faults in this area, which are considered to be tectonically active.

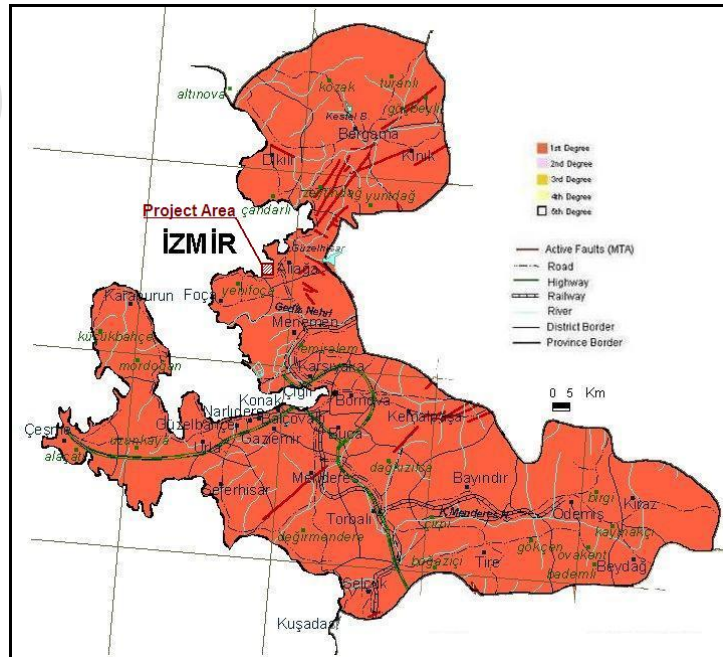


Figure 4-21 Earthquake Zone Map of İzmir Province

(Source: GDDA, 2009)

The Region has experienced courses of major earthquakes through out the history, which have magnitudes ranging between 4 and 7 (Figure 4-22).

Recently earthquakes data, which are taken from Kandilli Observatory and United States Geological Survey (USGS), are given in Table 4-4 and Table 4-5. These earthquakes show, tectonic activity is occurring periodically in Aegean Region.

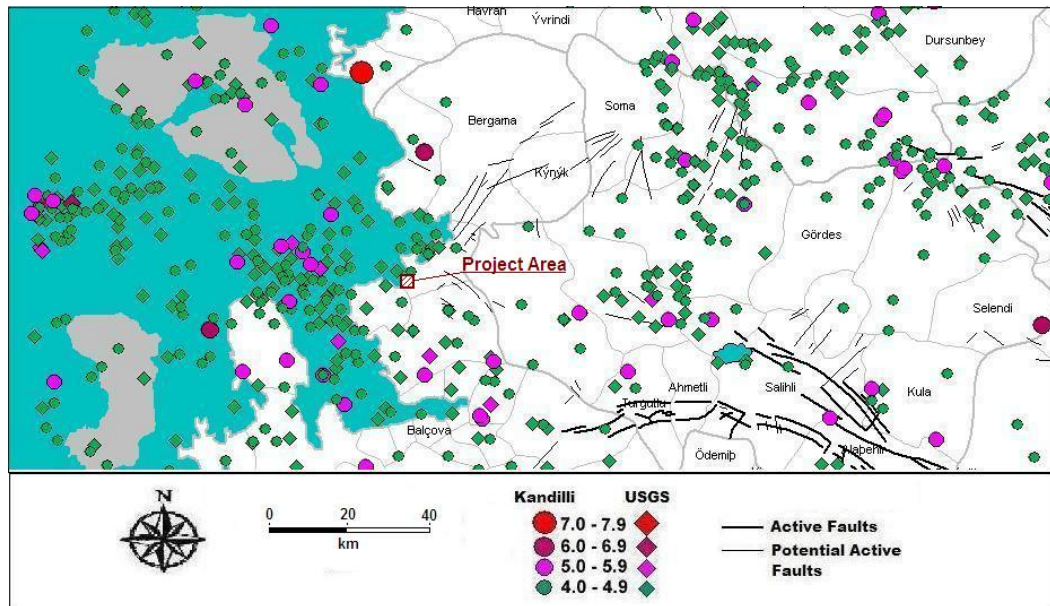


Figure 4-22 Distribution of Earthquakes with Magnitudes 4.0 or Higher Since the 20th Century
(Source: Sayısalgrafik, 2009)

Table 4-4 Earthquake History for the Regions
(Kandilli, 2009)

Kandilli Records					
DATE (d/m/y)	TIME (GMT)	Easting	Northing	Depth (km)	Magnitude
17.02.2009	5:28	39.10	29.00	7	5.0
09.11.2007	3:43	38.82	25.68	10	5.3
10.04.2003	0:40	38.26	26.83	16	5.6
22.06.2001	11:54	39.35	27.73	5	5.0
14.11.1997	21:38	38.86	25.74	12	5.8
24.05.1994	2:18	38.76	26.60	16	5.0
24.05.1994	2:05	38.66	26.54	17	5.0
28.01.1994	15:45	38.69	27.49	5	5.2
18.12.1985	5:46	39.20	26.17	17	5.0
17.06.1984	7:48	38.87	25.68	3	5.0
14.06.1979	11:44	38.79	26.57	15	5.9
16.12.1977	7:37	38.41	27.19	24	5.3
24.02.1977	20:47	38.55	27.66	20	5.0
01.02.1974	0:01	38.55	27.22	24	5.2
23.04.1970	9:01	39.13	28.65	28	5.2
30.04.1969	20:20	39.12	28.52	8	5.0
06.04.1969	3:49	38.47	26.41	16	5.6
28.03.1969	1:48	38.55	28.46	4	5.9
25.03.1969	13:21	39.25	28.44	37	5.5
24.03.1969	1:59	39.11	28.51	30	5.0
23.03.1969	21:08	39.14	28.48	9	5.6
03.11.1968	18:40	38.81	29.11	23	5.0
22.05.1966	7:37	38.70	27.92	23	5.1
02.03.1965	22:00	38.47	28.33	42	5.6
19.11.1959	14:00	38.89	26.65	10	5.3
20.11.1956	23:21	39.36	26.40	70	5.4
22.07.1953	15:09	39.24	28.43	10	5.2

02.05.1953	18:37	38.51	26.55	60	5.1
02.05.1953	5:41	38.48	26.67	40	5.0
01.05.1953	20:06	38.41	26.75	70	5.0
23.11.1949	16:51	38.75	26.36	60	5.2
23.07.1949	15:03	38.57	26.29	10	6.6
07.10.1944	21:34	39.22	26.58	10	5.2
25.06.1944	4:16	38.74	29.00	69	6.2
15.11.1942	17:01	39.55	28.58	10	6.1
28.10.1942	2:41	39.46	27.79	10	5.5
28.10.1942	2:22	39.10	27.80	50	5.9
28.10.1942	0:31	39.27	28.19	10	5.4
22.09.1939	0:36	39.07	26.94	10	6.6
02.01.1939	4:35	38.50	27.00	13	5.3
23.05.1937	10:57	38.69	27.78	10	5.4
14.03.1933	1:19	38.40	25.80	14	5.4
12.07.1931	22:24	39.15	26.34	10	5.3
13.01.1926	8:08	38.43	28.68	10	5.6
22.01.1924	11:05	39.51	28.40	80	5.3
24.07.1921	19:20	38.80	26.50	22	5.2
18.11.1919	21:54	39.26	26.71	10	7.0
23.06.1908	16:07	38.40	27.20	38	5.0
23.06.1908	14:45	38.40	27.20	25	5.1
23.06.1908	14:16	38.40	27.20	27	5.2
10.10.1904	17:40	38.40	27.20	20	5.8
19.05.1904	10:02	38.40	27.20	20	5.4
04.04.1903		39.00	28.00	20	5.5

Table 4-5 Earthquake History for the Regions
(USGS, 2009)

USGS Records					
DATE (d/m/y)	TIME (GMT)	Easting	Northing	Depth (km)	Magnitude
09.11.2007	23:11	38.73	25.72	9	5.5
09.11.2007	17:04	38.74	25.71	10	5.2
22.06.2001	11:54	39.31	27.91	10	5.0
25.07.1999	6:56	39.31	28.00	10	5.0
14.11.1997	21:38	38.86	25.80	17	6.1
24.05.1994	2:18	38.76	26.60	16	5.2
24.05.1994	2:05	38.66	26.54	17	5.5
28.01.1994	15:45	38.69	27.49	5	5.4
18.12.1985	5:46	39.20	26.17	19	5.0
17.06.1984	7:48	38.86	25.72	22	6.1
16.06.1979	18:42	38.75	26.63	18	5.1
14.06.1979	11:44	38.81	26.53	23	5.8
16.12.1977	7:37	38.44	27.22	34	5.3
24.02.1977	20:47	38.74	27.72	43	5.0
12.11.1976	9:55	38.57	26.71	6	5.2
01.02.1974	0:01	38.55	27.01	29	5.4

4.7 Hydrology and Hydrogeology

4.7.1 Surface Water

The proposed Project site is located in Güzelhisar basin which is a sub-basin of the Aegean Scattered Water Basin. Güzelhisar creek is approximately 70 km including its tributaries Kocaçay and Sirce creeks. The conjoining tributaries and Güzelhisar creek are collected on Güzelhisar dam (Figure 4-23).



Figure 4-23 Güzelhisar Basin (Modified from Google Earth, 2009)

Güzelhisar water dam was built in the region for the industrial facilities. It is located about 17 km from the Project site. Seasonal surface streams are also observed within the proposed Project area.

4.7.2 Springs

There are two hot water springs in Aliaga district. One of them is known as Biçer hot spring. According to the records of DSI (State Hydraulic Works); the specified resource temperature pertaining to this spring is 36°C and its flow rate is 30 l/s (Koç et al., 1967).

The other hot water source is the Aliaga coastal geothermal source. The discharge rate of this source is about 10 l/s and the temperature is 51°C (Filiz et al., 1997) which is under the conservation statue.

Within the region of the proposed Project site, geothermal studies were conducted by MTA (General Directorate of Mineral Research and Exploration) (Eşder et al., 1991). According to theses

researches it was concluded that the geothermal sources could be utilized for heating and greenhouse facilities in the future.

4.7.3 Groundwater and Wells

The Project site is located on Güzelhisar basin. The formations in the basin from bottom to top are Miocene Soma formation, Aliağa pyroclastic rock formations, Bozdivlik basaltic andesites and Quaternary alluvium.

The Soma formation which is located on İzmir Flysch reflects a volcano-sedimentary character with unconformity. The formations from bottom to top are; gravel, sandstone, silt-stone, clay-stone and marl.

The lithological units within the proposed Project site are comprised of sandstone, siltstone, limestone, marl and volcanic sediments (Eşder et al., 1991). Numerous wells in the basin are on this units. Despite the fact that it does not have a substantially high permeability, this formation has aquifer characteristics.

Aliağa pyroclastic rock formations are composed of clastic rhyolitic tuffs containing angular volcanic gravels. The formation has a low angle discordant contact with the Soma formation. Andesitic lava is observed occasionally in this unit (Melit et al., 1998). In terms of hydrogeological characteristics, Aliağa formation shows identical properties with the Soma formation.

Bozdivlik basaltic andesites outcrop in the close vicinity of the proposed Project site. These andesites are fractured, angular and black. The permeability of these rocks are higher compared to Soma formation. Since it comprises a small area and its extent diminishes with depth, its aquifer properties are limited.

These formations are recent alluvium that are settled in valley plains, alluvial fans and slope debris. The alluvial fans are mainly comprised of gravel and boulders of volcanic origin and the slope debris are observed as volcanic blocks settled around volcanic elevations. The thickness of alluvium changes from 10 to 60 m.

Present water supply wells are installed in Soma formations and Aliağa pyroclastic rock formation. According to State Hydraulic Works (DSİ) records, there are 16 registered exploration and groundwater supply wells within the boundaries of Güzelhisar Basin. The data on these wells are given in Table 4-6.

Table 4-6: Nearby Wells

No	Well ID	Coordinate		Yield (l/s)
		X	Y	
1	İLB.35/310	503003	4294798	14
2	İLB.35/1090	504223	4294717	20
3	İLB.35/304	504452	4294590	12
4	İLB.35/3066	502025	4293550	20
5	İLB.35/3065	502450	4293390	5
6	İLB.35/907	503000	4292650	12
7	İLB.35/816	503125	4292700	7.5
8	İLB.35/553	503196	4291917	30
9	İLB.35/2305	503341	4291833	42.5
10	İLB.35/2254	503600	4291758	13.5
11	İLB.35/2319	503590	4291507	9
12	K14	503601	4292977	39
13	K15	503699	4292629	40
14	K5	502582	4293654	-
15	K3	502350	4293475	-
16	DSİ 12823	502513	4293186	21.3

4.8 Flora

Methodology

In order to determine the flora species within the Project site and its vicinity, a site survey was conducted within the scope of the Project Description Report (PDR) by a local consultancy company. Flora inventory was prepared by AECOM using the results of the site survey and literature review. Results, including flora inventory, conservation status of flora species, any risk related to them are presented in this section.

As a result of the study, an inventory of flora species identified on Project site is prepared and presented in Table 4-7. The flora species in the table are listed in alphabetical order. The flora table presents the family, scientific name, Turkish name, common name, endemism and conservation status according to International Union for Conservation of Nature's (IUCN) Red List of Threatened Species and Bern Convention. In order to determine conservation status of the identified flora species "Red Data Book of Turkish Plants" (Ekim *et al.*, 2000) that is published by Turkish Association for the Conservation of Nature (*Türkiye Tabiatını Koruma Derneği*) and Turkish Taxonomic Species Database prepared by TUBITAK was utilized.

The categories of conservation status according to Red Data Book are as follows:

EX: Extinct	NT: Near Threatened
EW: Extinct In The Wild	LC: Least Concern
CR: Critically Endangered	DD: Data Deficient
EN: Endangered	NE: Not Evaluated
VU: Vulnerable	

Vegetation

The forest area constitutes nearly 40% of the total area in Izmir Province. Among these, 41% are coniferous trees, 53% are broad-leaved trees and 6% are maquis.

According to terrestrial eco-regions determined by the World Wildlife Fund (WWF), the Project site and its vicinity lies in the “Aegean and Western Turkey Sclerophyllous and Mixed Forests (PA1201)”. This eco-region is situated in the coastal lowlands and plains of western Turkey, much of mainland Greece, and many of the Aegean islands. Communities of maquis, dominated by evergreen shrubs and Callabrian pine (*Pinus brutia*), are the most common formations in this eco-region (National Geographic, 2009).

In addition, according to the vegetation map which was prepared by Izmir Regional Directorate of Forestry (Izmir Regional Directorate of Forestry, 2008), Anatolian Oak (*Quercus ilex*) dominates in the region where Project site lies. The natural vegetation map is given in Figure 4-24.

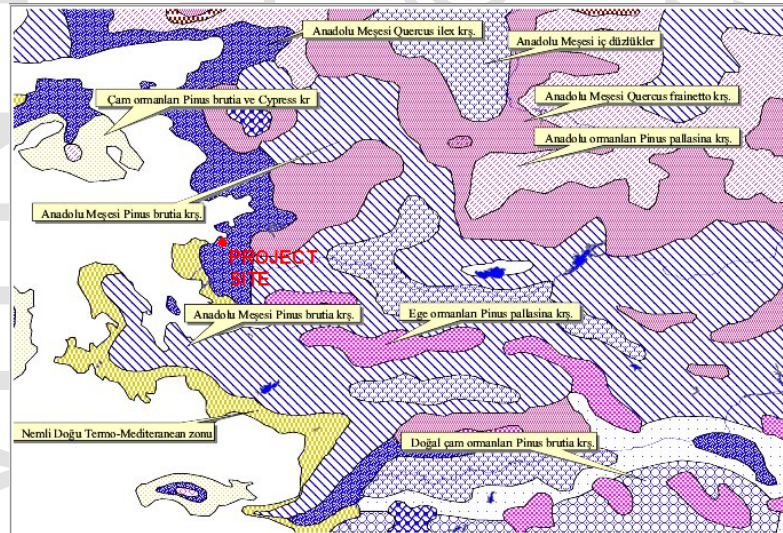


Figure 4-24 Natural Vegetation Map

(Source: Official Website of Izmir Regional Directorate of Forestry)

In accordance with the 1/5,000 Regulatory Development Map and 1/25,000 scaled topographic map, the Project site is located in the forestry area. However, during the site visit, it was observed that the site was dominantly covered by shrubs. The general views of these sites are presented in Figure 4-25.



Figure 4-25 General View of the Project Site

Floristic Analysis

As described in the methodology section, the flora table is prepared using the results of the site survey, literature review and the floristic study conducted in the close vicinity of the Project site (SRK, 2005). As a result of this inventory study, 74 species belonging to 31 families are identified in the Project area and its vicinity. Flora inventory is provided in Table 4-7.

As seen from Table 4-7, none of the species has conservation status in accordance with the Red Data Book and Bern Convention. In addition no endemic specie is determined according to the official website of Turkish Plants Data Service (TUBIVES).

Table 4-7 Flora Species

Scientific Name	Turkish Name	Common Name	RDB* (IUCN)	BERN	Endemism
Anacardiaceae					
<i>Pistacia lentiscus</i> L.	Sakız ağacı	Mastic tree	NE	-	-
Apiaceae					
<i>Ammi visnaga</i> (L.).	Diş otu (Kürdan)	Toothpickweed	NE	-	-
<i>Eryngium campestre</i> L. var. <i>virens</i> Link	Tokuz otu	Field Eryngo	NE	-	-
<i>Scandix pecten-veneris</i> L.	Çoban tarağı	Shepherdsneedle	NE	-	-
Asteraceae					
<i>Anthemis chia</i> L.	Papatya	Yellow camomile	NE	-	-
<i>Calendula arvensis</i> L.	Şamdan çiçeği	Field Marigold	NE	-	-
<i>Centaurea diffusa</i> Lam.	Zerdali diken	Diffuse knapweed	NE	-	-
<i>Centaurea iberica</i> Trev. Ex Sprengel	Deligöz diken	Iberian knapweed	NE	-	-
<i>Centaurea solstitialis</i> L. subsp. <i>solstitialis</i> L.	Güneş çiçeği	Yellow star-thistle	NE	-	-
<i>Cichorium intybus</i> L.	Hindiba	Chicory	NE	-	-
<i>Cirsium creticum</i> (Lam.) All.	Deve diken		NE	-	-
<i>Crepis micrantha</i> Czer.	Hindiba		NE	-	-
<i>Matricaria chamomilla</i> L. var. <i>cham omilla</i>	Kamille	Common Chamomile	NE	-	-
<i>Senecio vernalis</i> Waldst. et kit.	Kanarya otu	Eastern groundsel	NE	-	-
<i>Silybum marianum</i> (L.) Gaertner	Meryemana diken	Blessed Milk Thistle	NE	-	-
<i>Tragopogon longirostris</i> bisch. Ex Schultz	Yemlik	Long-Beaked Goat's	NE	-	-
Brassicaceae					
<i>Capsella bursa-pastoris</i> (L.) Medik	Oban Çantası	Little Hogweed	NE	-	-
<i>Sisymbrium officinale</i> (L.) Scop.	Lösel bülbül otu	Hedgemustard	NE	-	-
Boraginaceae					
<i>Echium plantagineum</i> L.	Adi engerek otu	Salvation Jane	NE	-	-
Campanulaceae					

Scientific Name	Turkish Name	Common Name	RDB* (IUCN)	BERN	Endemism
<i>Legousia speculum-veneris</i> (L.) Chaix		Large Venus's-Looking-	NE	-	-
Caryophyllaceae					
<i>Silene italica</i> (L.) Pers.	Nakil	Italian catchfly	NE	-	-
Cistaceae					
<i>Fumana thymifolia</i> (L.) Verlot var.	Kırgülü	Thyme Rock Rose	NE	-	-
Cyperaceae					
<i>Eleocharis palustris</i> (L.) Roemer et		Common Spikerush	NE	-	-
Ericaceae					
<i>Arbutus andrachne</i> L.	Sandal Ağacı	Eastern Strawberry tree	NE	-	-
Euphorbiaceae					
<i>Euphorbia falcata</i> L. subsp. <i>falcata</i> L.	Sütlegen	Sickle Spurge	NE	-	-
Fabaceae					
<i>Astragalus sinaicus</i>	Geven		NE	-	-
<i>Astragalus trojanus</i>	Geven		NE	-	-
<i>Hymenocarpus circinnatus</i> (L.) Savi	—	Disk Trefoil	NE	-	-
<i>Lathyrus aphaca</i> L. var. <i>pseudoaphaca</i>	Mürdümük	Yellow Pea	NE	-	-
<i>Lathyrus setifolius</i> L.	Mürdümük	Flat Peavine	NE	-	-
<i>Medicago coronata</i> (L.) Bart.	Yonca		NE	-	-
<i>Medicago orbicularis</i> (L.) Bart.	Yonca	Button clover	NE	-	-
<i>Pisum sativum</i> L. subsp. <i>Elatius</i>	Bezelye	Garden Pea	NE	-	-
<i>Trifolium campestre</i> Schreb	Üçgül	Hop trefoil	NE	-	-
<i>Trigonella monspeliaca</i> L.	Buy, Boy	Star-fruited Fenugreek	NE	-	-
<i>Vicia cracca</i> L. subsp. <i>stenophylla</i> Vel.	Fiğ		NE	-	-
Fagaceae					
<i>Quercus ilex</i> L.	Çalı meşesi	Holly Oak	NE	-	-
Geraniaceae					
<i>Erodium cicutarium</i> (L.) L'Herit. subsp.	Turna gagası	Redstem Stork's Bill	NE	-	-
<i>Geranium molle</i> L. subsp. <i>molle</i> L.	Kılçıksız turnagagası	Dovefoot Geranium	NE	-	-
<i>Geranium dissectum</i> L.	Turna gagası	Cutleaf Geranium	NE	-	-
<i>Geranium rotundifolium</i> L.		Roundleaf Geranium	NE	-	-
Liliaceae					
<i>Asphodelus aestivus</i> Brot.	Çiriş	Common Asphodel	NE	-	-
<i>Ornithogalum umbellatum</i> L.	Tükürük otu	Star of Bethlehem	NE	-	-
Loranthaceae					
<i>Viscum album</i> L. subsp. <i>Album</i>	Ökse otu	European Mistletoe	NE	-	-
Malvaceae					
<i>Malva sylvestris</i> L.	Hatmi	High Mallow	NE	-	-
Myrtaceae					
<i>Myrtus communis</i> L. subsp. <i>communis</i> L.	Mersin	Myrtle	NE	-	-
Oleaceae					
<i>Olea europaea</i> L. var. <i>Europaea</i>	Zeytin	Olive	NE	-	-
Papaveraceae					
<i>Hypecoum imberbe</i> Sibth. & Sm.	Boynuzlu kimyon	Sicklefruit hyecoum	NE	-	-
<i>Papaver gracile</i> Boiss.	Kara gelincik		NE	-	-
Pinaceae					
<i>Pinus brutia</i> Ten.	Kızıl Çam	Calabrian Pine	NE	-	-
<i>Pinus nigra</i> Arn. subsp. <i>pallasiana</i> (Lamb.)	Kara Ağaç	Austrian Pine	NE	-	-
Plantaginaceae					
<i>Plantago lanceolata</i> L.	Sinir otu	Narrowleaf Plantain	NE	-	-
Poaceae					
<i>Aegilops triuncialis</i> L. subsp. <i>Triuncialis</i>	—		NE	-	-
<i>Arundo donax</i> L.	Masura kamışı		NE	-	-
<i>Bromus madritensis</i> L.	Brom	Compact Brome	NE	-	-
<i>Catapodium rigidum</i> (L.) C.E.Hubbard ex	—	Ferngrass	NE	-	-
<i>Poa bulbosa</i> L.	Yumrulu salkım otu	Bulbous Bluegrass	NE	-	-
<i>Rostraria cristata</i> (L.) Tzvelev var. <i>Cristata</i>		Mediterranean Hairgrass	NE	-	-

Scientific Name	Turkish Name	Common Name	RDB* (IUCN)	BERN	Endemism
Polygonaceae					
<i>Polygonum cognatum</i> Meissn	Madımak	Indian knotgrass	NE	-	-
<i>Rumex acetosella</i> L.	Kuzu Kulağı	Common sheep sorrel	NE	-	-
Portulacaceae					
<i>Portulaca oleracea</i> L.	Semiz otu		NE	-	-
Primulaceae					
<i>Anagallis arvensis</i> L. var. <i>arvensis</i>	Fare kulağı	Scarlet Pimpernel	NE	-	-
Ranunculaceae					
<i>Adonis flammea</i> Jacq.	Kan Damlası		NE	-	-
<i>Ranunculus arvensis</i> L.		Corn buttercup	NE	-	-
<i>Ranunculus cadmicus</i> Boiss.	Düğün çiçeği	Buttercup	NE	-	-
<i>Ranunculus constantinopolitanus</i> (dc.)	Düğün çiçeği	Constantine buttercup	NE	-	-
<i>Ranunculus illyricus</i> L. subsp. <i>illyricus</i>	Düğün çiçeği		NE	-	-
Rosaceae					
<i>Amygdalus graeca</i> Lindley	Badem		NE	-	-
<i>Potentilla reptans</i> L.	Beşparmak otu	Creeping Cinquefoil	NE	-	-
<i>Pyrus elaeagnifolia</i> Pallas subsp.	Ahlat		NE	-	-
Rubiaceae					
<i>Galium verum</i> L. subsp. <i>verum</i> L.	Sarı Yoğurt Otu	Yellow Bedstraw	NE	-	-
<i>Sherardia arvensis</i> L.	Tarla kök boyası	Field Madder	NE	-	-
Verbenaceae					
<i>Vitex agnus-castus</i> L.	Hayt	Lilac Chastetree	NE	-	-
Ulmaceae					
<i>Ulmus minor</i> Miller subsp. <i>canescens</i>	Karaağaç		NE	-	-

* Red Data Book of Turkish Plants

NE: Not Evaluated

4.9 Fauna

4.9.1 Amphibians and Reptiles

The fauna species of the Project site and its vicinity was determined in the scope of the PDR submitted to the İzmir Provincial Directorate of Environment and Forestry. In addition, the study conducted in the close vicinity of the Project site (SRK, 2005) was also referred in order to determine the species that are likely to exist in the proposed Project site. Literature survey was also conducted to prepare fauna inventory. In this regard, "Vertebrates of Turkey, Amphibians" (*Türkiye Omurgalıları, Amfibiler*) by Demirsoy (2006) and "Vertebrates of Turkey, Reptiles" (*Türkiye Omurgalıları, Sürüngenler*) by Demirsoy (2006) was reviewed. Results of the fauna inventory are discussed in this section.

As a result of this study, four (4) amphibian and nine (9) reptile species were determined as most likely to exist in the Project site and its vicinity. AECOM has checked the conservation statuses of these species in accordance with the Official Website of IUCN Red List version 2009.1.

Amphibian inventory is provided in Table 4-8. All amphibian species that are likely to exist in the Project site and its close vicinity are classified as LC (least concern) according to IUCN Red List. *Pelobates syriacus* (European Spadefoot Toad) and *Bufo viridis* (European Green Toad) are included

in Annex II of Bern Convention which list strictly protected fauna species. Other amphibians are included in Annex III of Bern Convention which list protected fauna species.

As seen in Table 4-9, nine (9) reptile species were identified as most likely to exist in the Project site and its vicinity. Among these species, *Elaphe quatuorlineata* (Four-lined Rat Snake) is classified as NT (Near threatened) and *Testudo graeca* (Common Tortoise) is classified as VU (vulnerable) category according to IUCN Red List. However, *Elaphe quatuorlineata* (Four-lined Rat Snake) and *Testudo graeca* (Common Tortoise) are abundant and widely seen in Turkey. Five (5) of these species are included in Annex II of Bern Convention (strictly protected fauna) and other four (4) are included in Annex III of Bern Convention (protected fauna).

Table 4-8 Amphibians

Scientific Name	Common Name	Turkish Name	IUCN 2009	BERN	Endemism
ANURA					
<i>Bufo bufo</i>	Common Toad	Karakurbağası	LC	App.-III	-
<i>Bufo viridis</i>	European Green Toad	Gecekurbağası	LC	App.-II	-
<i>Pelobates syriacus</i>	European Spadefoot Toad	Toprakkurbağası	LC	App.-II	-
<i>Rana ridibunda</i>	Marsh Frog	Ovakurbağası	LC	App.-III	-

Table 4-9 Reptiles

Scientific Name	Common Name	Turkish Name	IUCN 2009	BERN	Endemism
CHELONIA					
<i>Testudo graeca</i>	Spur-thighed Tortoise	Tosbağa	VU	App.-II	-
SQUAMATA					
<i>Agama stellio</i>	Starred Agama	Dikenli Keler	NE	App.-II	-
<i>Ablepharus kitaibelli</i>	European copper skink	İncekertenkele	NE	App.-III	NE
<i>Elaphe quatuorlineata sauromates</i>	Eastern Four-Lined Snake	Sarıyılan	NT	App.-II	-
<i>Elaphe situla</i>	Leopard Snake	Evyılanı	LC	App.-II	-
<i>Hemidactylus turcicus</i>	Mediterranean house gecko	Geniş Parmaklı Keler	LC	App.-III	-
<i>Hieropi (=Coluber) jugularis</i>	Red-Bellied Racer	Kara yılan	LC	App.-II	-
<i>Mabuya aurata</i>	Golden Grass Mabuya	Tıknaç Kertenkele	LC	App.-III	-
<i>Ophisops elegans macrodactylus</i>	Snake-eyed Lizard	Tarla Kertenkelesi	NE	App.-II	NE

* All species are protected by the MoEF in accordance with the 2009-2010 Decisions of Central Hunting Commission.

As a result of this study, no endemic or endangered amphibian and reptile species were determined in the Project area in accordance with the IUCN Red List of Threatened Species and Bern Convention.

4.9.2 Mammals

The fauna species of the Project site and its vicinity was determined in the scope of the PDR submitted to the İzmir Provincial Directorate of Environment and Forestry. In addition, the study conducted in the close vicinity of the Project site (SRK, 2005) was also referred in order to determine the species that are likely to exist in the proposed Project site. Literature review was also done. In this regard, "Vertebrates of Turkey, Mammals" (*Türkiye Omurgalıları, Memeliler*) by Demirsoy (2006) was used. Conservation statuses of all of these species in accordance with the Official Website of IUCN Red List version 2009.1 and Bern Convention and information whether they are included in the 2009 – 2010 decisions of Central Hunting Commission (CHC) are presented in Table 4-10.

As seen in Table 4-10, 12 species are identified as most likely to exist in the Project site and its vicinity. Four (4) of these species are included in Annex II of Bern Convention (strictly protected fauna) and two (2) species are included in Annex III of Bern Convention (protected fauna). Among these species, no endemic or near-threatened, vulnerable or endangered, mammals species were identified in the Project area in accordance with the IUCN Red List of Threatened Species and Bern Convention.

Table 4-10 Mammals

Scientific Name	Common Name	Turkish Name	IUCN 2009	BERN	CHC 2009-2010*	Endemism
ARTIODACTYLA						
<i>Sus scrofa scrofa</i>	Wild Boar	Yabani domuz	LC	-	App.-III	-
CARNIVORA						
<i>Vulpes vulpes</i>	Red Fox	Kızıltıki	LC	-	App.-III	-
CHIROPTERA						
<i>Rhinolophus ferrumequinum</i>	Greater Horseshoe Bat	Büyük Nalburunluyarasa	LC	App.-II	App.-I	-
<i>Rhinolophus hipposideros</i>	Lesser Horseshoe Bat	Küçük Nalburunluyarasa	NE	App.-II	App.-I	NE
<i>Myotis mystacinus</i>	Whiskered Bat	Bıyıklı Yarasa	LC	App.-II	App.-I	-
INSECTIVORA						
<i>Erinaceus concolor</i>	Southern White-breasted Hedgehog	Kirpi	LC	-	App.-I	NE
<i>Crociodura leucodon</i>	Bicolored Shrew	Sivriburunlu Tarla faresi	LC	App.-III	-	NE
LAGOMORPHA						
<i>Lepus europaeus</i>	European Hare	Yabani tavşan	LC	App.-III	App.-III	-
RODENTIA						
<i>Sciurus anomalus</i>	Caucasian Squirrel	Kafkassincabı	LC	App.-II	-	-
<i>Spalax leucodon</i>	Lesser Mole Rat	Körfare	DD	-	-	-
<i>Apodemus sylvaticus</i>	Wood Mouse	Ormanfaresi	LC	-	-	-
<i>Apodemus flavicollis</i>	Yellow Necked Mouse	Sarıboyunlu Ormanfaresi	LC	-	-	-

* CHC: Central Hunting Commission

App. I: species protected by the MoEF

App. II: species protected by the CHC

App. III: species allowed to be hunted for a time period

4.9.3 Birds

Bird Species in the Project Area

In the PDR subjected to the İzmir Provincial Directorate of Environmental and Forestry, the bird species in the Project site and its close vicinity were identified. In accordance with this study, ten (10) bird species are identified within the Project area and its close vicinity. In addition, the study conducted in the close vicinity of the Project site (SRK, 2005) was also referred in order to determine the species that are likely to exist in the proposed Project site. The species given in both the PDR and the previous study are provided in Table 4-11. Conservation status and habitat of bird species was found and listed in the table. Table 4-11 provides information on scientific names, common names, Turkish names and conservation status information in accordance with IUCN, Bern Convention and Turkish Central Hunting Commission Decisions and information on their habitats. Information on birds' habitats was mostly gathered from the Official Website of IUCN.

As seen in Table 4-11, thirty-seven (37) bird species have been observed at the observation points in total. Fifteen (15) and seventeen (17) of these species are included in Annex II and Annex III of Bern Convention, respectively. In addition, all species are classified as LC (least concern) category. All species prefer to live in terrestrial habitats except *Phalacrocorax carbo* (Kormoran), *Motacilla alba* (Pied Wagtail) and *Larus cachinnans* (Yellow-legged Gull) which show preference for water bodies (wetlands, marine, rivers, lakes etc.).

Alternative project locations are discussed in detail in Section 8 of the report. As indicated in that section, project area lies in the best location for wind potential according to Wind Atlas of Turkey (SMI, 2009). In order to minimize bird collision risk, wind turbines will be painted and lighting will be installed as appropriate. Mitigations are discussed thoroughly in Chapter 5.

Table 4-11 Birds

Scientific Name	Turkish Name	Common Name	IUCN 2009	BERN	CHC 2009-2010	Habitat
PELECANIFORMES						
<i>Phalacrocorax carbo</i>	Karabatak	Kormoran	LC	App-III	App.-II	Wetlands & Marine
CICONIIFORMES						
<i>Ciconia ciconia</i>	White Stork	Leylek	LC	App.- II	App.- I	Terrestrial
FALCONIFORMES						
<i>Circus pygargus</i>	Çayır doğanı	Montagu's Harrier	LC	App-II	App-I	Terrestrial
<i>Buteo rufinus</i>	Kızıl şahin	Long-legged Buzzard	LC	App-II	App-I	Terrestrial
<i>Falco tinnunculus</i>	Kerkenez	Kestrel	LC	App-II	App-I	Terrestrial
COLUMBIFORMES						
<i>Columba livia</i>	Kaya güvercini	Rock Dove	LC	App.-III	App.-III	Terrestrial
<i>Streptopelia decaocto</i>	Kumru	Collared Dove	LC	App.-III	-	Terrestrial
STRIGIFORMES						
<i>Athene noctua</i>	Kukumav	Little Owl	LC	App-II	App-I	Terrestrial
APODIFORMES						
<i>Apus apus</i>	Ebabil, Kara sağan	Swift	LC	App-III	App-I	Terrestrial
<i>Apus melba</i>	Akkarınli ebabil	Alpine Swift	LC	App-II	App-I	Terrestrial
PASSERIFORMES						
<i>Melanocorypha</i>	Küçük boğmaklı	Bimaculated Lark	LC	App-II	App-I	Terrestrial
<i>Galerida cristata</i>	Tepeli toygar	Crested Lark	LC	App.-III	App.-II	Terrestrial
<i>Alauda arvensis</i>	Tarlakuşu	Skylark	LC	App-III	App-II	Terrestrial
<i>Hirundo rustica</i>	İs kırlangıcı	Swallow	LC	App.-II	App.-I	Terrestrial
<i>Delichon urbica</i>	Pencere kırlangıcı	House Martin	LC	App-II	App.-I	Terrestrial
<i>Motacilla alba</i>	Ak kuyruksallayan	Pied Wagtail	LC	App.-II	App.-I	Wetlands
<i>Saxicola torquatus</i>	Çayır taşkuşu	Stonechat	LC	App-III	App.-I	Terrestrial
<i>Oenanthe oenanthe</i>	Kuyrukkakan	Northern	LC	App-III	App-I	Terrestrial
<i>Turdus merula</i>	Karatavuk	Blackbird	LC	App.-III	App.-III	Terrestrial
<i>Sylvia melanocephala</i>	Karabaş küçük ötögen	Sardinian	LC	App.- II	App.-I	Terrestrial

Scientific Name	Turkish Name	Common Name	IUCN 2009	BERN	CHC 2009-2010	Habitat
<i>Phylloscopus collybita</i>	Cif caf		LC	App.-III	App.-I	Terrestrial
<i>Parus major</i>	Büyük baştankara	Great Tit	LC	App.- III	App.- I	Terrestrial
<i>Luscinia megarhynchos</i>	Common Nightingale	Bülbül	LC	App.- II	App.-I	Terrestrial
LANIIDAE						
<i>Lanius collurio</i>	Çekirgekuşu	Red-backed Shrike	LC	App-II	App-I	Terrestrial
<i>Garrulus glandarius</i>	Kestane kargası	Jay	LC	App.-III	App.-III	Terrestrial
<i>Pica pica</i>	Saksağan	Magpie	LC	-	App.-III	Terrestrial
<i>Corvus monedula</i>	Cüce karga	Jackdaw	LC	App-III	App-III	Terrestrial
<i>Corvus frugilegus</i>	Ekin kargası	Rook	LC	-	App-III	Terrestrial
<i>C.corone cornix</i>	Leş Kargası	Hooded Crow	LC	-	App-III	Terrestrial
<i>Sturnus vulgaris</i>	Sığırcık	Starling	LC	-	App-II	Terrestrial
<i>Passer domesticus</i>	Ev serçesi	House Sparrow	LC	-	App-III	Terrestrial
<i>Passer montanus</i>	Dağ serçesi	Tree Sparrow	LC	App-III	App-III	Terrestrial
<i>Fringilla coelebs</i>	İspinoz	Chaffinch	LC	App.-III	App.-II	Terrestrial
<i>Carduelis carduelis</i>	Saka	Goldfinch	LC	App.- II	App.- I	Terrestrial
<i>Carduelis chloris</i>	Florya	Greenfinch	LC	App.-II	App.-I	Terrestrial
<i>Miliaria calandra</i>	Tarla kirazkuşu	Corn Bunting	LC	App.- III	App.- II	Terrestrial
LARIDAE						
<i>Larus cachinnans</i>	Yellow-legged Gull	Gümüş Martı	LC	App.-III	App.- II	Water

LC: Least Concern

CHC: Central Hunting Commission

App. I: species protected by the MoEF

App. II: species protected by the CHC

App. III: species allowed to be hunted for a time period

LEAST CONCERN (LC) A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened.

Widespread and abundant taxa are included in this category.

Migratory Birds

Bird migration is a seasonal journey undertaken by many species of birds. These regular journeys result from change in food availability, habitat or weather. Many bird populations migrate long distances along a flyway between their breeding and wintering habitats.

The most common pattern involves flying in the fall from Northern Hemisphere to wintering grounds in warmer regions to the south, and returning to the north in the spring to breed in the temperate or Arctic summer.

Since there are many wetlands in Turkey, the Eurasian migrants flying to the south use these wetlands as a nesting area. While majority of the migratory birds flying through the Balkans prefers Bosphorus and Dardanelles, the birds flying through the Caucasus migrate along the mountain valleys in Eastern Black Sea. These birds finally concentrate around Belen Pass in Hatay Province (Okan C., 2004). These migration routes are presented in Figure 4-26. As seen in the figure, bird migration routes do not pass through the Project site.

Important Bird Areas

The European Important Bird Area (IBA) Program is implemented through national IBA Programs in 29 countries with the support and co-ordination of the European Division of the BirdLife Secretariat. The IBAs in Turkey have identified by the Society for the Protection of Nature (Doğal Hayatı Koruma Derneği) and BirdLife International and this study was published as a book called "Important Bird Areas in Turkey" in 1997. The book was revised in 2004 by the Nature Society (Doğa Derneği) and Birdlife International with additional support from Royal Society for the Protection of Birds (RSPB).

The closest IBAs to the Project site is determined according to revised version of the book and visualized in Figure 4-27. As seen from the Figure, the Project site is located within and near the border of the Foça Peninsula Important Bird Area (IBA). In addition, there are also Gediz Fan IBA and Çiçek Island IBA in the vicinity of the Project site. Gediz Fan IBA and Çiçek Islands IBA are in the south-west of the closest turbine (T-4) with the distances of approximately 15 km and 29 km, respectively.

Foça Peninsula IBA lies between Gediz River and Aliağa District at the eastern entrance of İzmir Bay. The IBA also contains Foça Islands consisting of six uninitiated islands. Dominant vegetation in the region is Mediterranean vegetation and part of the region is covered with maquis and pinewood. In addition, there is a coastal zone with open-air space. Foça Peninsula IBA hosts Monk Seal (*Monachus monachus*). This area is breeding area for *Phalacrocorax aristotelis* (European Shag) and *Hieraaetus fasciatus* (Bonelli's Eagle).

The Project site that is situated within the border of Foça Peninsula IBA is also located in close vicinity of heavily industrial zone as indicated earlier. Therefore, the current industrial activities in the area are most likely disturb birds and force them to prefer more suitable places for wintering and stopovers. However, the potential impacts of the proposed Project onto birds and related mitigation measures are thoroughly discussed in Chapter 5.



Figure 4-26 Bird Migration Routes in Turkey

Source: <http://www.kusgribi.gov.tr>
 Ministry of Agriculture and Rural Affairs
 General Directorate of Conservation and Control
 Department of Animal Health

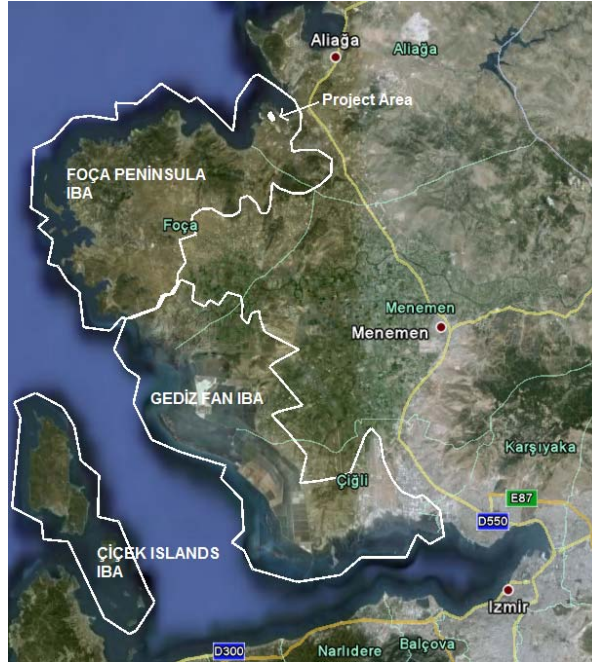


Figure 4-27 Closest Important Bird Areas to the Project Site

(Source: Important Bird Areas in Turkey, 2004 Revision, Doğa Derneği)

Wetlands

Wetlands might be good places for feeding and living of birds. Thus, existence of wetlands in an area might indicate potential for observing migratory birds and/or resident bird habitats. According to the list of wetlands presented in the Official Website of Ministry of Environment and Forestry, General Directorate of Nature Conservation and National Parks, the Project site does not lie within any wetland of international importance. The closest wetland to the Project site is Gediz Fan Wetland which is also an IBA presented in the previous section. This wetland is located about 29 km to the proposed site. It should be noted that this wetland is one of the wetlands protected by the Ramsar Convention (The Convention on Wetlands of International Importance).

4.10 Naturally Protected Areas

In accordance with the national environmental legislation, there are no national parks, nature reserves, natural monuments, wildlife protection areas and wildlife improvement areas within the Project site and its vicinity. The Project site is located within and near the northern border of the Foça Peninsula Key Biodiversity Areas (KBA) and there are two more KBAs in the vicinity of the Project site. Brief information about these KBAs are in the following sections.

Key Biodiversity Areas

Key Biodiversity Areas (KBAs) are places of international importance for the conservation of biodiversity at the global level. The concept of KBAs has been developed by conservation organizations including Bird Life International, Conservation International and Plant Life International. The scientific studies in order to determine the KBAs in Turkey are being carried out by Doğa Derneği

with the support of the Royal Society for the Protection of Birds and Birdlife International. In 2006, Doğa Derneği published the book “Key Biodiversity Areas of Turkey” which is also available in the Official Website of Doğa Derneği.

These KBAs also constitute the basis of scientific studies that are carried out within the scope of Natura 2000 network for Turkey’s EU accession process. Natura 2000 is an ecological network of protected areas in the territory of the European Union (EU). There are two directives of EU that form the Natura 2000 network. These are the Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds) and the Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora). In order to meet the requirements of these directives, Doğa Derneği and the Ministry of Environment and Forestry are carrying out studies in cooperation. The revision of the book “Important Bird Areas in Turkey” and the publication of the book “Key Biodiversity Areas of Turkey” by Doğa Derneği can be considered within this context.

According to the book “Key Biodiversity Areas of Turkey”, the Project Site is located within Foça Peninsula KBA and there are also Gediz Fan KBA and Çiçek Islands KBA in the vicinity of the Project Area. These areas are presented in Figure 4-28.

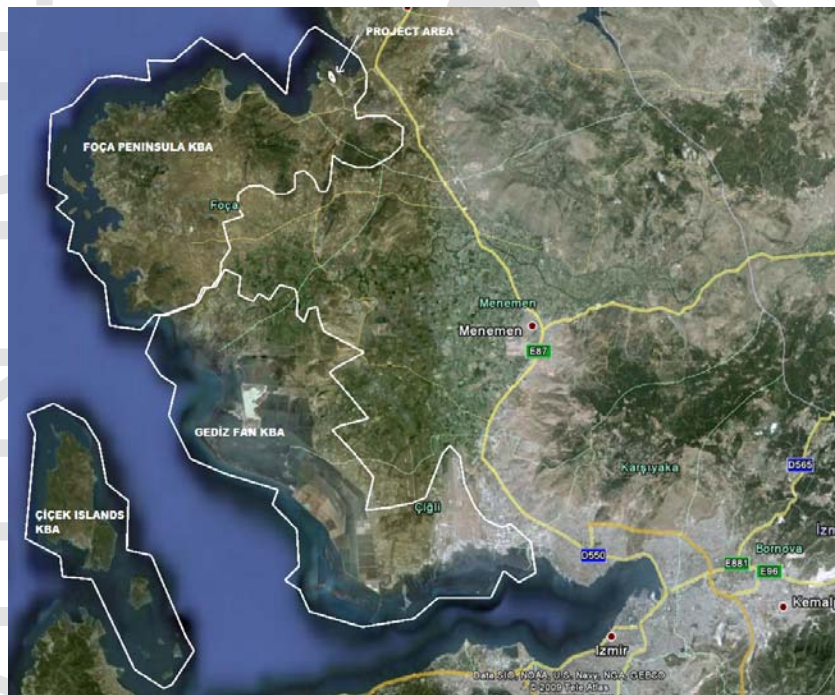


Figure 4-28 Key Biodiversity Areas

It should be noted that Foça Peninsula KBA, Gediz KBA and Çiçek Islands KBA also correspond to the Foça Peninsula IBA, Gediz IBA and Çiçek Islands IBA as mentioned in the previous section. Since the ecological criteria used for determination of the IBAs are the same as the criteria used for KBAs, 184 KBAs in Turkey also correspond to IBAs.

The Project site is located within the boundaries of Foça Peninsula KBA. Foça Peninsula KBA consists of coves with an indented coastline, promontories and islands. The IBA also contains six uninhabited islands namely; İncir, Fener, Orak, Metelik ve Kartdere. Dominant vegetation in the

region is Mediterranean vegetation and part of the region is covered with maquis and pinewood. In addition, there is a coastal zone with open-air space. Foça Peninsula KBA hosts *Monachus monachus* (Monk Seal). This area is breeding area for *Phalacrocorax aristotelis* (European Shag) and *Hieraaetus fasciatus* (Bonelli's Eagle).

Furthermore, part of the Foça Peninsula KBA was registered as Foça Special Protected Site by the Council of Ministers Decision on October 22, 1990 and has an area of 71.38 km². The distance between the Foça Special Protected Site and the closest turbine (T-2) is approximately 13 km. Foça Peninsula KBA and Foça Special Protected Site are presented in Figure 4-29. It should be noted that part of the site was registered as 1st and 2nd Degree Nature Protection Area.



Figure 4-29 Foça Special Protected Area located within the Foça Peninsula KBA

4.11 Archeological Areas

İzmir is an important tourism center of Turkey. There are many historical places such as Tepekule (Smyrna), Kadifekale, Agora, Kızılçullu Su Kemerleri (Kızılçullu Aqueducts), Kemeraltı, Hisar Mosque within the borders of the province. The proposed Project site is located within Aliğa District of İzmir Province. There are several ancient city and archaeologically protected site within Aliğa District. The data for the important archeologically protected areas in vicinity of the Project site are gathered from the 1/5,000 Regulatory Development Plan and 1/250,000 scaled Turkey Geographical Maps. This data is plotted on Figure 4-30 to demonstrate the archeologically protected areas in the vicinity of the Project site.

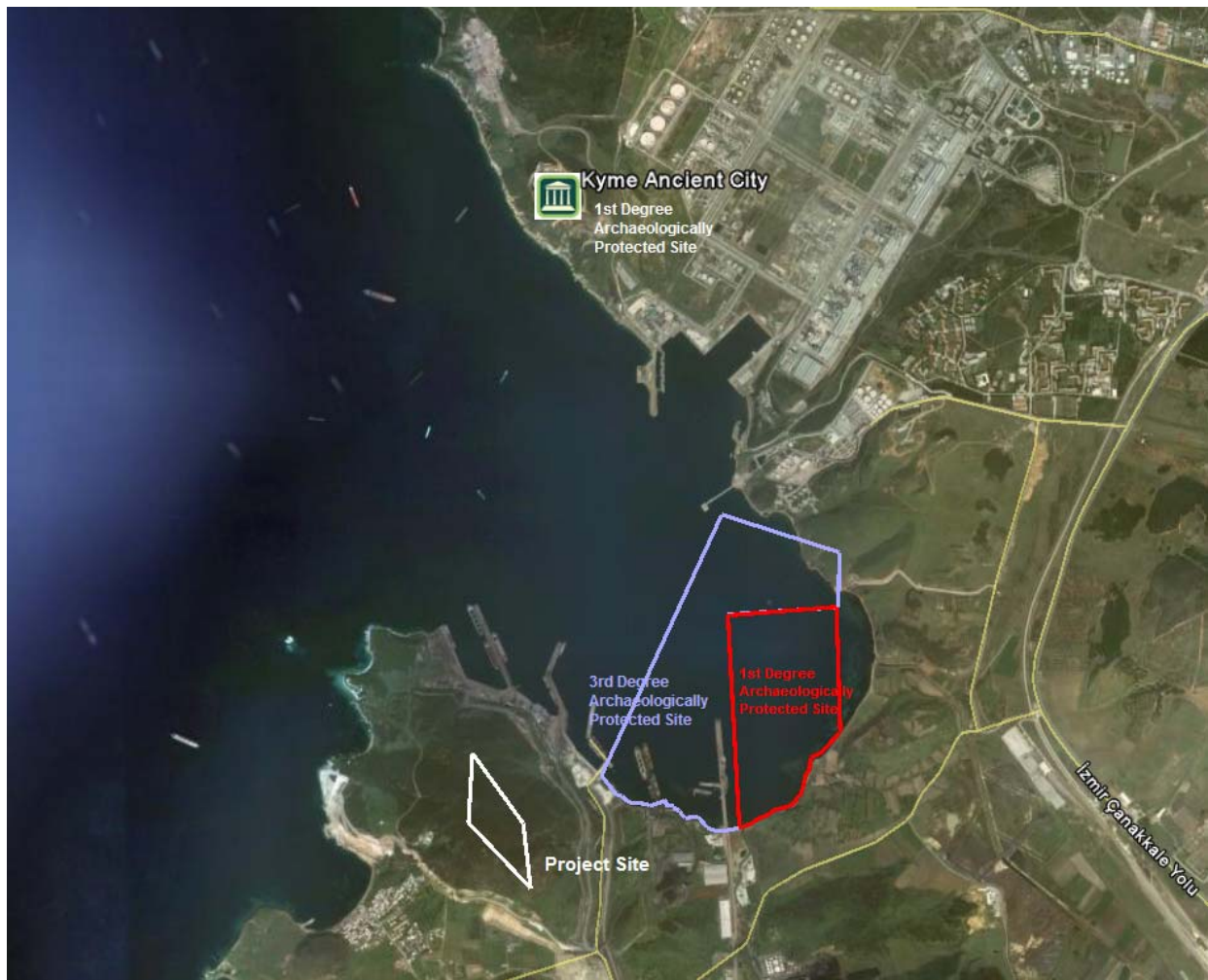


Figure 4-30 Archaeologically Protected Areas in the Vicinity of the Project Area

As seen from the Figure 4-30, the closest archaeologically protected sites to the proposed Project sites are Nameless 3rd Degree Archaeologically Protected Site and Nameless 1st Degree Archaeologically Protected Site which are located approximately 0.5 km and 1.2 km to the Turbine 3 (T-3) which is closest turbine to both archaeologically protected sites. In addition to these archeologically protected sites, Kyme Ancient City which was registered as Kyme Ancient City 1st Degree Archaeologically Protected Site by the Council of Cultural and Natural Heritage Preservation Board on September 30, 1996 is located approximately 3 km to the closest Turbine T-1. Kyme Ancient City is located next to the largest petrochemical production complex. The proposed wind farm Project will not have any adverse effect on these archeologically protected areas.

4.12 Socio-Economic Characteristics

4.12.1.1 Settlements and Demographics

Karadağ Wind Power Plant will be located in Aliağa of İzmir Province. İzmir has an area of 7,350 km². Total population and population density is 3,795,978 and 316, respectively, according to the results of the Address Based Population Census conducted by the Turkish Statistical Institute (TUIK) in the year of 2008. Aliağa District is located approximately 45 km to the north-east of İzmir Province

Center. Aliağa has a surface area of 393 km². According to the 2008 census results, the total population and population density of the district is 62,208 and 209, respectively. Majority of people in the Aliağa District live in the urban area. The rural population of the district is 49,508 whereas rural regulation is 12,750. There are 18 villages in Aliağa District.

The nearest settlements to the Project site are Çakmaklı Village and Horozgediği Village. Çakmaklı Village and Horozgediği Village have populations of 799 and 355 according to the 2008 census data.

4.12.1.2 Livelihoods and Economics

Subsequent to the establishment of the petrochemical facilities, Aliağa expanded into an industrial city in the last 20 years. In the early 1960s the economy of Aliağa was based upon agricultural activities. In accordance with the aims of the planned development courses of the 1961 Constitutional Law, Aliağa District was claimed to become a heavy industry area. From then on the city's economy gained an industrial character. The largest petrochemical industry of the country, iron and steel plants and arc furnaces and mills are present in the city. With the industrialization of the city, 40 heavy industry facilities and 1577 workshops were established. In the late 1970's the private sector investments commenced and mostly completed in the 1990's. Private iron-steel facilities like Çukurova, İzmir Demir Çelik, Ege Metal, Çebitaş, Habaş, precision casting factories and wreckage facilities were established in this era. Apart from the petrochemical industry and arc furnaces, there are also ship-demolition facilities, scrap metal operations, paper mills, fertilizer production facilities, iron-steel factories, rolling mills and sea transport establishments in Aliağa. A total of 16,067 personnel is being employed in these facilities.

Agriculture and animal husbandry lost their significance with the raising of industry in Aliağa in the last 40 years. The agricultural activities are present only in Güzelhisar and Helvacı plains. The most important agricultural goods of the region are cotton, tobacco, olive and grapes. Irrigational agriculture has been initiated in the last years in Helvacı plain. A plain that lies in the south of Gediz, namely Menemen plain is also available for pasturage, irrigated and dry farming and fishery. 62% of the 3317 ha area of the agricultural lands is irrigated by the public utilities and 38% is irrigated by the canals of State Hydraulic Works.

5.0 ENVIRONMENTAL IMPACTS

5.1 Noise

5.1.1 Construction

Construction inevitably creates some degree of noise emissions at locations in close vicinity of the construction activities. However, construction noise is temporary and transient in nature. The noise levels generated by construction works would have the potential to impact on noise sensitive receptors. Noise levels during construction at a receptor depends on several factors such as number and type of equipment and machinery used, the distance between noise sensitive receptor and the construction site and level of attenuation likely due to ground absorption, air absorption and barrier effects.

Type and Number of Construction Machines

Type and number of equipment and machines that will be used during construction activities and their equivalent noise levels are listed in Table 5-1.

Table 5-1 Sound Power Levels of the Equipment and Machines

Machine	Number	Lw(dB)
Concrete Mixer	2	115
Loader	2	115
Dozer	1	115
Backhoe Loader	1	105
Crane	2	105
Dumper Truck	5	105
Generator	1	97
Welder	5	97

Total Noise Level at the Source

The noise levels are calculated assuming that all machines/equipment will operate at the same time at one location in order to demonstrate the worst case situation.

Total equivalent noise level generated by all noise sources is calculated with the formula (RAMEN, Annex-I) given below:

$$L_{eq} = 10 \times \log \left[\frac{2 \times 10^{115/10} + 2 \times 10^{115/10} + 1 \times 10^{115/10} + 1 \times 10^{105/10} + 2 \times 10^{105/10}}{+ 5 \times 10^{105/10} + 1 \times 10^{97/10} + 5 \times 10^{97/10}} \right] = 103.99 dBA$$

where;

n: Number of noise source;

L_i: Sound power level of each source (dBA);

L_{eq}: Total equivalent noise level.

The total equivalent noise level at the construction activity location, assuming all construction equipment is operating, is calculated as 103.99 dBA.

Total Noise Level at the Receptors

In order to assess noise impacts of construction activities at the noise sensitive receptor (NSR) described in Section 4.4, the closest turbine location to the NSR is chosen as the construction activity location. This closest turbine to NSR is Turbine 2 (T2) with a distance of 486 m.

Air absorption is assumed as 0 in order to simulate the worst case situation, and thus, the following formula (RAMEN, Annex-I) is used to calculate the noise levels of construction works at the noise sensitive receptor;

$$L_p = L_{eq} + 10 \times \log \left(\frac{Q}{4 \cdot \pi \cdot r^2} \right)$$

where;

L_p: Noise power level at the receptor (dBA);

Q: ground absorption coefficient (assumed as 2);

r: distance between the source and the receptor.

The noise levels at different distances are calculated using the above formula and the results are given in Table 5-2 below.

Table 5-2 Noise Levels at NSR and Different Distances

Distance (m)	L _p (dBA)
0	103.99
100	56.0
150	52.5
200	50.0
300	46.5
400	44.0
486 (NSR)	42.3
500	42.0
750	38.5
1000	36.0
1500	32.5
2000	30.0
2500	28.0

In addition to tabular noise level results at different distances, a graphical view of decreasing noise levels with increasing distances is shown in Figure 5-1.

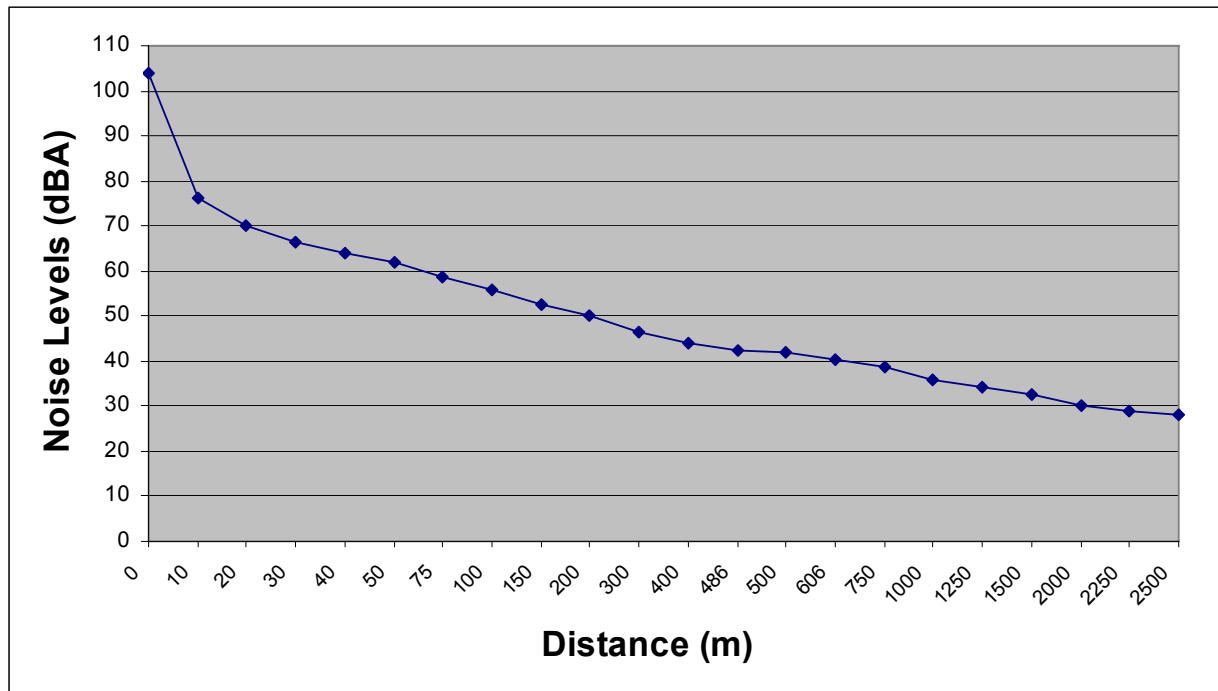


Figure 5-1 Noise Distribution during Construction

As can be seen in Table 5-2, noise level generated from construction activities at NSR is calculated as 42.3 dBA.

In accordance with the Article 23(1)-b of the Regulation on Assessment and Management of Environmental Noise (RAMEN), the construction activities within residential areas and in the close vicinity cannot be carried out during evenings and nighttime except the daytime period (07:00-19:00). RAMEN also states construction site noise level limits which are given in Table 2-2 of Section 2.1.5. According to this table, the Project site is classified as “Other Resources” and the noise level limit in this class of areas is set to 70 dBA. Turkish RAMEN noise limits are complied with at the nearest sensitive receptor during construction phase of the Project.

In addition to the regulatory compliance demonstrated above, construction noise is temporary and transient in nature and can be controlled through good site working practices, limiting construction hours and adopting noise control measures where necessary. Thus, noise impact associated with the construction activities is not expected to be a significant issue for the Project.

5.1.2 Operation

Operating wind turbines generate noise varying with wind speed. The sources of sounds emitted from wind turbines consist of 1) mechanical sounds and 2) aerodynamic sounds.

Mechanical sound originates from the rotation of mechanical and electrical equipment. Sources of mechanical sounds include gearbox, generator, yaw drives, cooling fans and auxiliary equipment. Mechanical sounds can be transmitted directly to air (air-borne) or transmitted along structural components before noise is radiated into the air (structure-borne).

Aerodynamic sound originates from the flow of air around the blades. Continuous improvements in mechanical design of large wind turbines have resulted in significant reductions in mechanical sounds. Presently, noise emissions from modern wind turbines mostly come from broadband aerodynamic sounds.

Since the operating wind turbines generate noise, there is a potential impact at the neighboring residential homes. Thus, a noise impact assessment is carried out for this Project.

Noise assessment study basically consists of the following major steps:

1. Selection of methodology;
2. Noise survey to determine existing ambient background noise levels;
3. Noise levels predicted or measured for the turbines;
4. Applying a sound propagation model;
5. Specifying noise criteria;
6. Comparison of estimated sound pressure levels with noise criteria.

5.1.2.1 Methodology

General guidance and regulatory policy concerning noise associated with new developments in Turkey is provided by the Turkish Regulation on Assessment and Management of Environmental Noise (RAMEN). IFC/WB EHS guidelines for wind energy also provides noise limits that should not be exceeded during the operation of the proposed wind farm. However, it is apparent that existing noise standards do not fully address the issues associated with the unique characteristics of wind farm developments and there is a need for an agreed methodology for defining acceptable noise limits for wind farm developments. The Turkish Ministry of Environment or IFC/WB does not provide any noise assessment methodology for the wind farm development.

In the UK, a methodology was developed for the Department of Trade and Industry (DTI) by the Working Group on Noise from Wind Turbines (WGNWT) and known as ETSU-R-97, The Assessment and Rating of Noise from Wind Farms (1996). ETSU-R-97 provides a robust basis for determining the noise criteria for wind farms and has become a well-respected and accepted standard for such developments. This methodology has therefore been adopted for this Project.

5.1.2.2 Noise Background Survey

As described in the previous section in detail, concurrently noise and wind speed/direction was measured at the nearest NSR. During the survey, $L_{A90-10min}$ data was collected. Generally, $L_{90,10min}$ is taken as for both the background noise and the wind farm noise in noise assessment studies (ETSU-R-97, 1997; Rogers, et al, 2006; EPA 2008). L_{A90} is the A-weighted sound levels that are exceeded 90% of the time. The use of the $L_{A90-10min}$ data avoids corruption of data from relatively loud, transitory noise events from other sources. Thus, in this assessment, $L_{A90-10min}$ is used for the calculation of the

background noise levels and also for the wind farm. It should be noted that $L_{A90-10min}$ is likely to be about 2 dBA less than the L_{Aeq} measured over the same time (ETSU-R-97, 1997).

10-minute averaged concurrent wind and background noise level measurements were carried out. The measured L_{A90} noise levels are then plotted against simultaneously measured wind speed data for daytime and nighttime hours. A “best fit” curve is fitted to the data to establish the background noise level as a function of wind speed as shown in Figure 5-2 below.

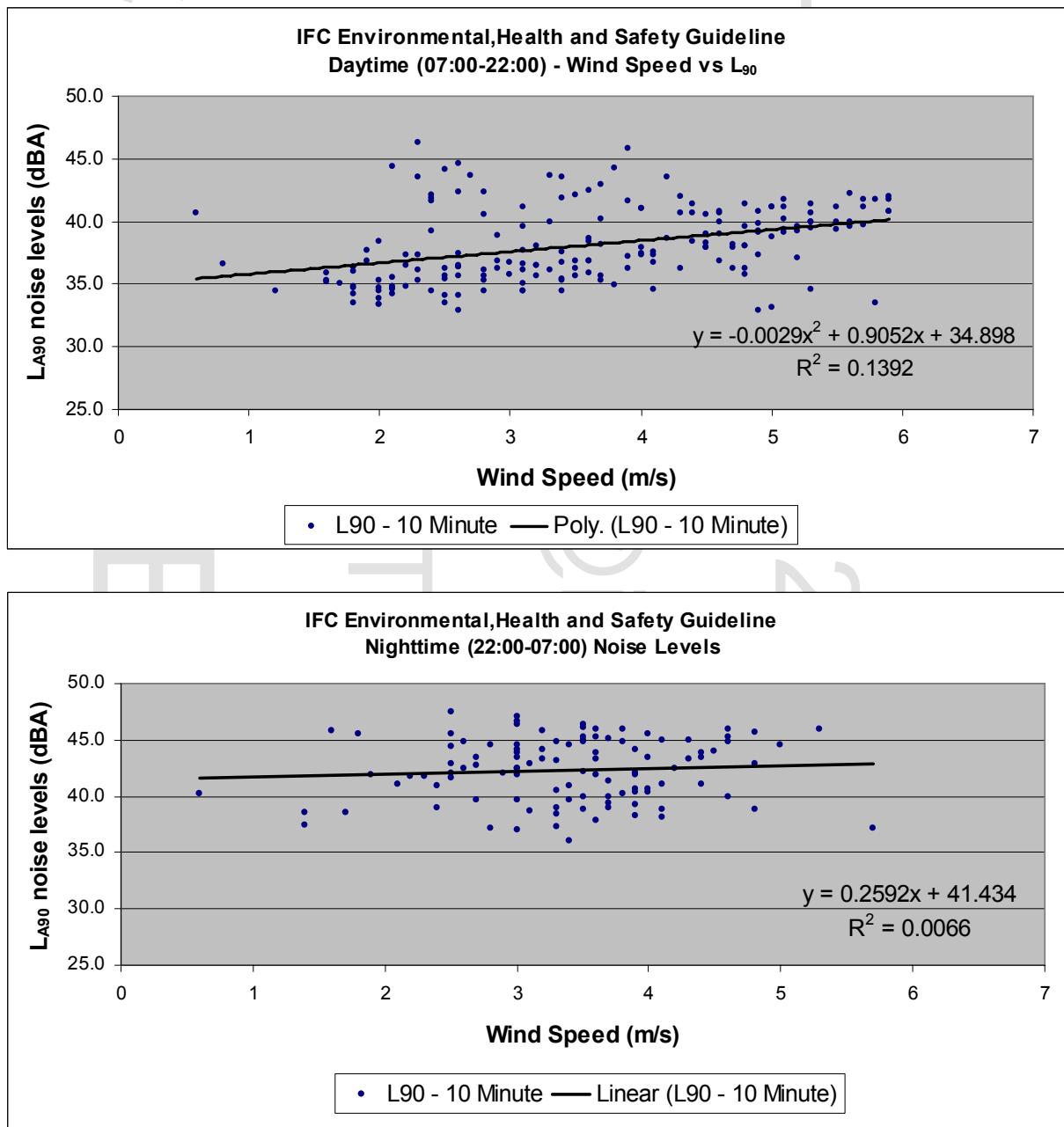


Figure 5-2 Daytime and Nighttime Wind Speed vs L_{A90} Background Noise Level Plots

5.1.2.3 Turbine Noise Characteristics

GE 2.5XL 50 Hz model turbines will be used in the Project. The noise levels generated by the model GE 2.5XL is obtained from the turbine manufacturer. The noise data includes octave band spectra and broadband levels as the variation of sound output with wind speed over a range of 3 to 10 m/s (referenced to a 10 m height). Octave band spectrum and broadband noise levels at each wind speed are given in Tables 5-3 and 5-4, respectively.

Table 5-3 Octave Band Spectra of GE 2.5 XL at 10m/s Wind Speed

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
L_{wa} (dBA)	72.3	95.0	100.3	98.3	93.7	97	95.5	72.1

Table 5-4 Broadband Noise Levels at each Wind Speed from 3 to 10 m/s

Wind Speed (m/s)	3	4	5	6	7	8	9	10
Noise Emission, L_{wa} (dBA)	96.0	96.0	99.3	103.4	105.0	105.0	105.0	105.0

5.1.2.4 Noise Propagation Model

The potential noise impact of the wind turbines on sensitive receptors is determined by noise modeling. Commercially available WindPro version 2.6 noise propagation model, which is based on ISO 9613-2, is used in this Project. The model is capable of utilizing different propagation modules, for a variety of wind speed, and it incorporates terrain data into calculations. The model also includes absorbances due to atmosphere and nearby surfaces. Ambient noise levels at the nearest sensitive receptor (NSR) are modeled under worst case conditions.

The model contained within ISO 9613-2 Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General method of Calculation (1996) has been used to calculate the noise emission levels at the nearest sensitive receptor. The ISO 9613-2 algorithm, which is one of the available models presented in WindPro software, has been chosen as being the most robust prediction method based on the findings of a joint European Commission (EC) research Project into wind farm noise propagation over large distances.

Although it is not possible to specify exact error bands on noise predictions, the ISO 9613-2 model was found to be the best available, both in flat and hilly, complex terrain. ISO 9613-2, like all the other models, tends to over-estimate the noise at the nearest sensitive receptor, rather than under-estimate it. The study performed as part of the EC research (“Development of a Wind Farm Noise Prediction Model”, JOR3-CT95-0051) concluded that the ISO 9613-2 method tended to predict noise levels that would generally occur under downwind propagation conditions. The probability of non-exceedence of the levels predicted by the ISO 9613-2 algorithm was about 85%. The same research also demonstrated that under upwind propagation conditions, between a given receiver and the wind farm, the noise level at that receiver will be as much as 10dB(A) to 15dB(A) lower.

Model Inputs

ISO 9613-2 model uses the following equation in calculating the noise levels at the receptor locations.

$$L(DW) = LWA_{ref} + K + Dc - (Adiv + Aatm + Agr + Abar + Amisc) - Cmet$$

where,

$L(DW)$: Calculated noise level at the receptor, dBA

LWA_{ref} : Noise emission of Wind Turbine, dBA

K : Pure tone, dBA

Dc : Directivity correction, dB

$Adiv$: Attenuation due to the geometrical divergence, dB

$Aatm$: Attenuation due to atmospheric absorption, dB

Agr : Attenuation due to ground effect, dB

$Abar$: Attenuation due to a barrier, dB

$Amisc$: Attenuation due to miscellaneous other effects, dB

$Cmet$: Meteorological correction, dB

All the input values except LWA_{ref} are calculated according to coordinates of the wind turbines and noise sensitive receptor. Turbine noise emission levels given in Table 5-4 are used as LWA_{ref} values but deducted 2 dB as a fair approximation of the LA_{90} levels. Other inputs and assumptions used for the noise propagation model are as follows;

- Wind turbine and noise sensitive receptor coordinates,
- 10-m elevation contour data of the Project site is used to determine ground effect,
- Meteorological coefficient value is assumed as 0 dB to represent worst case conditions,
- Pure tone value is assumed as 0 dB according to information obtained from turbine manufacturer,
- Air absorption value is assumed 1.9 dB/km, default value of ISO 9613-2.

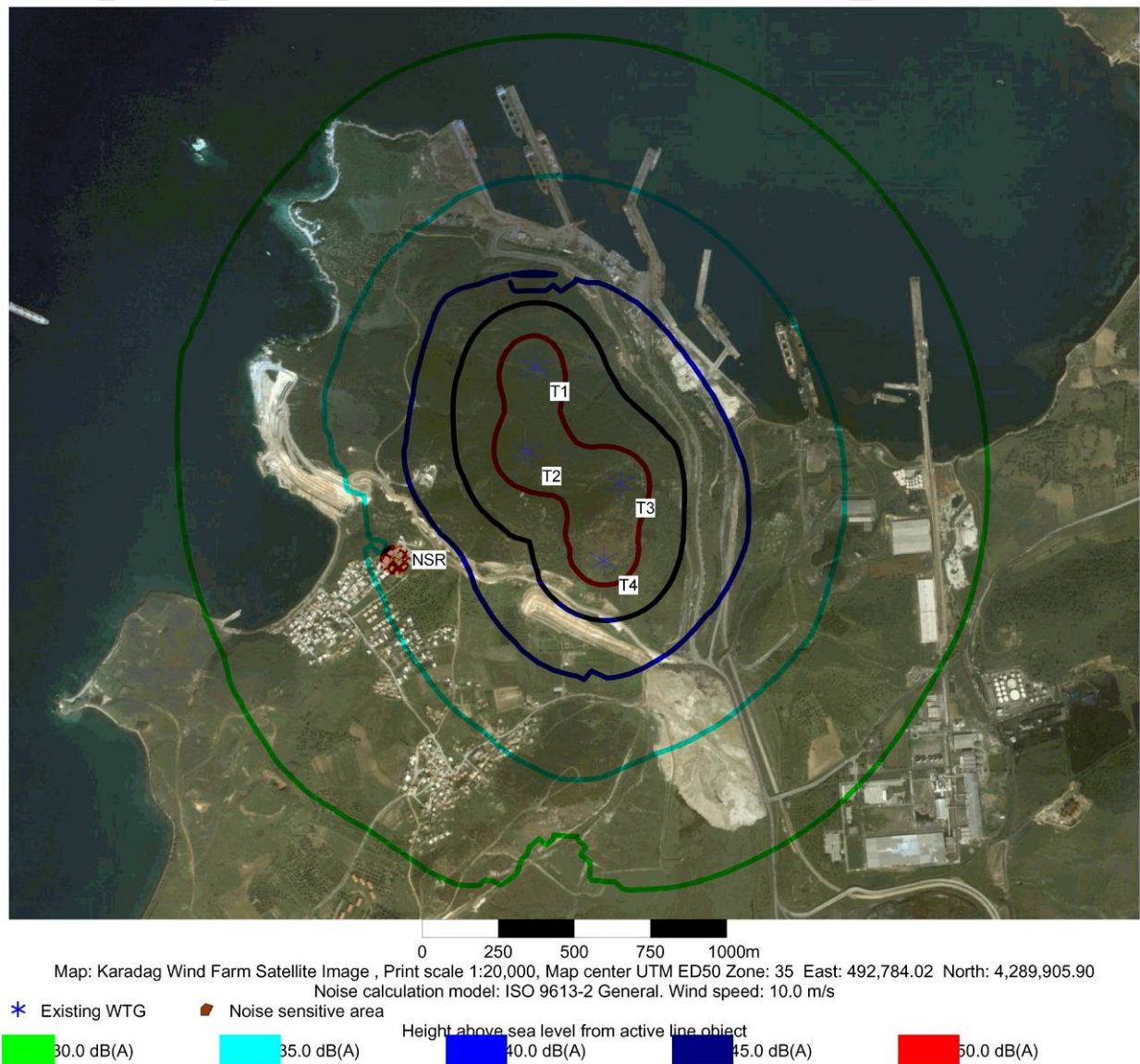
Model Output

Predicted turbine noise levels at the NSR, in terms of LA_{90} , over the wind speed range from 3 m/s to 10 m/s are estimated with the model and shown in Table 5-5 below.

Table 5-5 Predicted Wind Farm Noise Emission Levels at the NSR

	Wind Speed (m/s)							
	3	4	5	6	7	8	9	10
Noise Emission Levels at the NSR (dBA)	30.2	31.2	32.2	33.1	34.1	35.1	36.1	37.1

Noise contour map obtained from the results of noise modeling is given in Figure 5-3.

**Figure 5-3 Noise Contour Map**

5.1.2.5 Noise Criteria

In this assessment, five noise criteria are used:

1. A constant regulatory noise limit set for the daytime (07:00-19:00); evening time (19:00-23:00) and nighttime (23:00-07:00) by the Turkish noise regulation (RAMEN). These noise limits are 68 dBA, 63 dBA and 58 dBA, for the daytime, evening time and nighttime, respectively. Since L_{A90} is the most appropriate descriptor to represent background noise levels and the background noise levels are determined as $L_{A90-10min}$ during the noise survey in this study, the Turkish noise criterion is set to 66 dBA, 61 dBA and 56 dBA for the daytime, evening time and nighttime, respectively, by simply subtracting 2 dBA from the L_{Aeq} values. The regulatory noise criterion is an absolute value that does not vary with the background wind speed.
2. The IFC/WB noise guideline limit is given as L_{Aeq} and is set for 55 dBA for daytime (07:00-22:00) and 45 dBA for nighttime (22:00-07:00). For this assessment, the limits are set to 53 dBA for daytime and 43 dBA for nighttime to be compared with the $L_{A90-10min}$ background values. The IFC/WB noise criterion is an absolute value that does not vary with the background wind speed. It should be also noted that the nighttime absolute lower limit of 43 dBA is also based on World Health Organization guidelines for the protection of sleep indoors with windows open.

If the above stated criteria are not met, then the following criteria are used:

3. The IFC/WB noise guideline states that if the noise impact is above the IFC/WB limits then it requires that proposed activities should not result in a maximum increase in background levels of 3 dBA at the nearest receptor.
4. The RAMEN states that if the noise impact is above the RAMEN limits then it requires that proposed activities should not result in a maximum increase in background levels of 5 dBA at the nearest receptor.
5. The ETSU-R-97 noise criterion is based on a level 5 dBA above the best fit curve over the 3-10 m/s wind speed range (actually the ETSU-R-97 criterion is similar to the IFC/WB criterion given above). If the ETSU-R-97 criterion curve is found to be below the IFC/WB nighttime absolute value of 43 dBA (since this value is the lowest of all absolute limits given by RAMEN and IFC/EB), it is basically fixed at 43 dBA.

Thus, the noise criteria set either at the prevailing measured background level plus 3 dBA and 5 dBA or the absolute lower limits, whichever is the greater.

5.1.2.6 Comparison of Noise Impact with Noise Criteria

Noise impact values result from turbine operation at the NSR for daytime and nighttime periods are calculated as a function of wind speed from 3 m/s to 10 m/s and given in Table 5-6 with the background noise levels and the difference between background noise levels and cumulative noise levels.

Background noise levels for each wind speed from 3 m/s to 10 m/s for daytime and nighttime periods are calculated by using the equation of regression curve given in Figure 5-2.

Table 5-6 Daytime and Nighttime Cumulative Noise Levels

		Wind Speed (m/s)							
		3	4	5	6	7	8	9	10
Turbine Noise Emission Levels, dBA		30.2	31.2	32.2	33.1	34.1	35.1	36.1	37.1
Daytime Period (07:00 – 22:00)	Background Noise Levels, dBA	37.6	38.5	39.4	40.2	41.1	42.0	42.8	43.7
Nighttime Period (22:00 – 07:00)	Background Noise Levels, dBA	42.2	42.5	42.7	43.0	43.2	43.5	43.8	44.0

In addition to the tabulated view of noise impact values of the proposed Project, graphical representation of noise impact values at the NSR and the noise criteria for both daytime and nighttime periods are shown in Figure 5-4.

As can be seen in Table 5-6 and Figure 5-4, the predicted noise levels at the NSR are well below the absolute noise criteria of RAMEN and IFC/WB for daytime and nighttime. Moreover, the differences between predicted noise levels and background noise levels in daytime and nighttime periods are below 5 dB at all wind speeds indicating compliance with the ETSU-R-97 noise criteria.

This noise assessment study has demonstrated that the operational noise of the proposed wind farm Project will not exceed the Turkish noise regulation and IFC/WB and daytime and nighttime noise limits. Thus, the noise impacts associated with the proposed wind farm Project will be negligible.

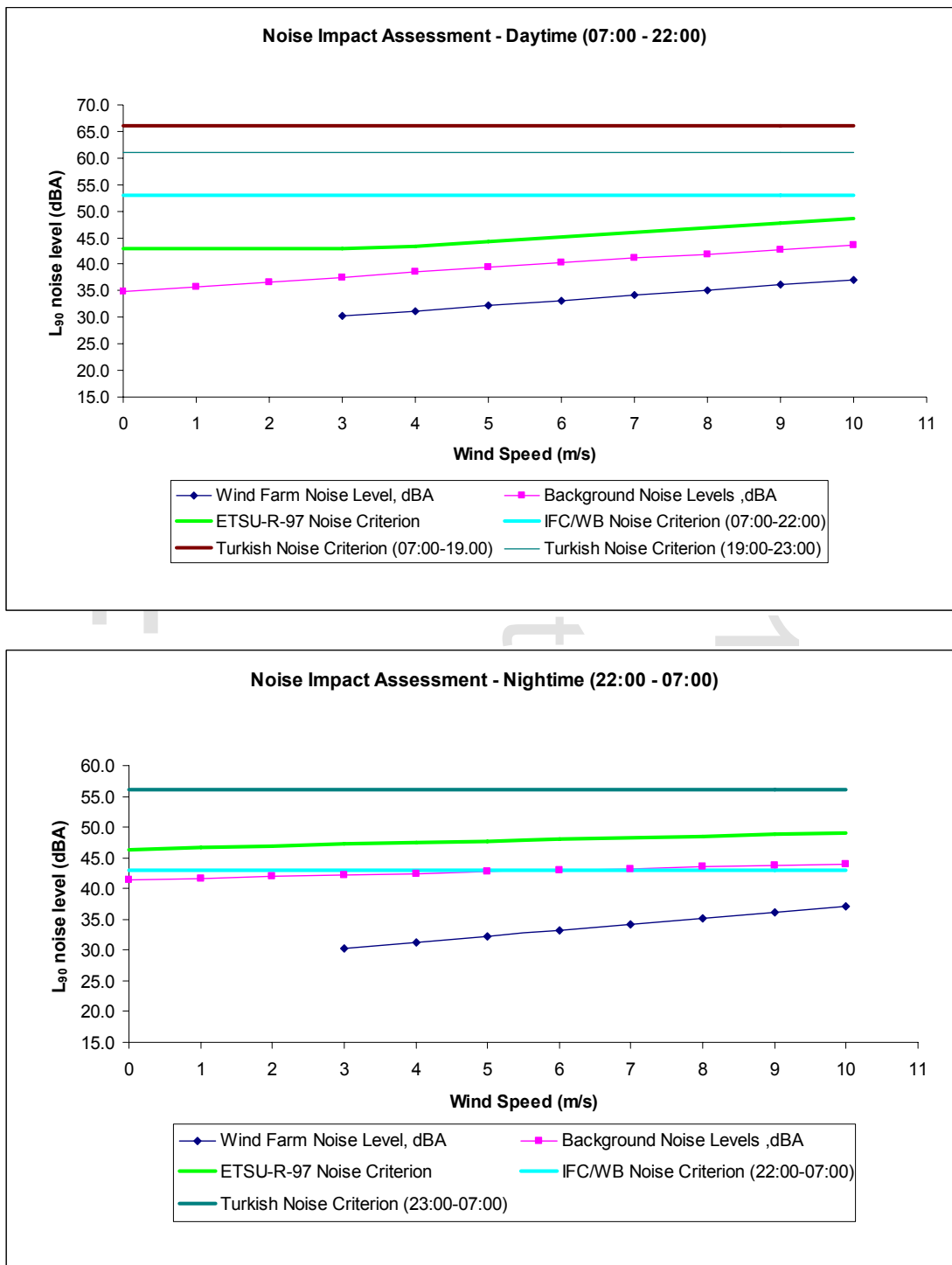


Figure 5-4 Daytime and Nighttime Wind Farm Noise Levels Compared to Noise Criteria

5.1.3 Decommissioning

Noise levels during decommissioning are expected to be similar to the noise levels during construction. Decommissioning noise will be temporary and transient in nature and like the construction activities, it can be controlled through good site working practices, limiting

decommissioning hours and adopting noise control measures where and when necessary. Thus, noise impacts associated with the decommissioning activities are not expected to be a significant issue for the proposed Project.

5.2 Air Emissions

5.2.1 Construction

Main emission sources during the construction period are excavation activities, heavy construction vehicles, material loading and unloading and heating systems of the camping area in case the camping area is established. The construction period will be approximately a year.

Exhaust Emissions

During civil works, the earth moving vehicles, heavy vehicles used for the transportation of excavation materials and generators will burn diesel fuel and fuel consumption will be about 15 l per vehicle in an hour. It is assumed that four construction vehicles will be in operation at the same time. Hence, the hourly total diesel consumption at the construction site will be 60 liters.

USEPA AP-42 Emission Factors are used for the calculation of emissions generated by the diesel fired vehicles. Since the emissions, generated due to operation of these vehicles, will include sulphur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM₁₀) and total organic carbon/volatile organic carbon (TOC/VOC), hourly mass flow of these pollutants were calculated individually.

Calorific value of diesel = 137,000 BTU/gal x gal/4.54609 l = 30,135.8 BTU/l.

Emissions from construction vehicles are as follow;

Carbon monoxide	: 0.95 lb/(10 ⁶ BTU) x 30,135.8 BTU/l x 60 l/hr x 0,4536 kg/1 lb = 0.78 kg/hr
Sulfur oxides	: 0.29 lb/(10 ⁶ BTU) x 30,135.8 BTU/l x 60 l/hr x 0,4536 kg/1 lb = 0.24 kg/hr
Total Organic Carbon	: 0.35 lb/(10 ⁶ BTU) x 30,135.8 BTU/l x 60 l/hr x 0,4536 kg/1 lb = 0.29 kg/hr
Nitrogen oxides	: 4.41 lb/(10 ⁶ BTU) x 30,135.8 BTU/l x 60 l/hr x 0,4536 kg/1 lb = 3.62 kg/hr
Dust(PM ₁₀)	: 0.31 lb/(10 ⁶ BTU) x 30,135.8 BTU/l x 60 l/hr x 0,4536 kg/1 lb = 0.25 kg/hr

Taking into account the dispersion effect of the wind in the Project area and short duration of the construction, it can be concluded that the proposed Project will not affect the local air quality during the construction.

Dust Emissions Due to Excavation

Dust will be mainly generated from earth moving for excavation and back filling activities during wind turbine construction, switchyard, access roads and transmission line construction. Approximate construction area and excavation durations are presented in Table 5-7. It is assumed that construction works will be performed 26 days a month and 8 hours a day.

Table 5-7 Construction Area

Construction Site	Construction Area (m ²)	Excavation Duration (month)
Wind Turbines	1,764	1.25
Switchyard and Administration Building	16,760	3
Access Roads and Cabling Trenches	34,560	3

The formula used for the calculation of the maximum hourly dust emission amount is as follows:

$$\text{Dust Emission Amount} = (E \times \text{construction area}) / \text{construction period}$$

Emission factor (E) is 10.34 g/m²/day according to USEPA Air Pollutants Emission Factors (AP-42). Dust emissions that will be generated during the excavation operations is given in the following:

Wind Turbines

$$= 10.34 \text{ g/m}^2/\text{days} \times 1,764 \text{ m}^2 / (4 \text{ months} \times 26 \text{ days/month} \times 8 \text{ hour}) = 0.021 \text{ kg/hr}$$

Switchyard and Administration Building

$$= 10.34 \text{ g/m}^2/\text{days} \times 16,760 \text{ m}^2 / (3 \text{ months} \times 26 \text{ days/month} \times 8 \text{ hour}) = 0.28 \text{ kg/hr}$$

Access Roads and Cabling Trenches

$$= 10.34 \text{ g/m}^2/\text{days} \times 34,560 \text{ m}^2 / (4 \text{ months} \times 26 \text{ days/month} \times 8 \text{ hour}) = 0.43 \text{ kg/hr}$$

In order to prevent dust generation, roads will be sprinkled with water regularly, loading and unloading of material that could generate dust will be done without throwing into the air; loads on the hauling vehicles will be covered with tarpaulin type material while in transport. Materials deposited on stockpiles on site will be closely monitored for any emission of dust and if required they will be damped down, covered or treated with a dust suppressant.

All heavy commercial vehicles leaving the site will be washed to prevent the transmission of soil from the site to the public roads. Vehicles will be encouraged to reduce their speed while moving around the site during dry weather to minimize disturbance.

All such mitigation measures will further reduce the amount of dust generated and therefore it is not expected that dust generated during construction activities will create any adverse effects on the local air quality. The proposed Project will comply with the Air Quality Assessment and Management Regulation. Thus, no negative long-term air quality impacts are likely to occur.

5.2.2 Operation

Wind power generation is a non-combustion process that relies on the direct conversion of mechanical energy into electrical energy. Thus, during operation, fossil fuels will not be used for power generation and air emissions will not be generated. There will be no emission resulting from heating since catalytic heater or electric power will be used for heating purposes. There will be an emergency generator, however, the emissions associated with the temporary operation of the emergency generator, if occurs, is not expected to impact the local air quality. Therefore, the proposed Project will not have any adverse impact on local air quality during operation.

5.2.3 Decommissioning

It is expected that emissions resulting from the decommissioning activities will be minor and similar with the construction phase. Main emission source will be dust due to earth moving activities. However, quantity of the dust to be generated during the decommissioning of the Project will be less than the dust emissions generated during the construction phase of the proposed Project since there will be little earth moving required. Necessary precautions will be taken in order to minimize the generation and spread of dust.

5.3 Water Supply and Wastewater

5.3.1 Construction

Preferably, the water required for the construction works, dust suppression and wheel will be carried out by tanker trucks. In case the potable water demand of personnel is supplied from the groundwater resources, necessary permit will be secured from the State Hydraulic Works. This amount of water is insignificant compared to the local water resources and will not impact adversely the local surface or groundwater resources. In addition, drinking water will be supplied by bottled water.

Only domestic wastewater will be generated throughout the construction period of the Project. It is assumed that a single person requires about 150 l/day water and this water will return as wastewater completely. Then the total wastewater generation during construction period will be as follows:

Total number of persons engaged	: 46
Water required	: 150 l/person/day = 0.15 m ³ /person/day
Total water requirement	: 0.15 m ³ /person/day x 50 persons = 6.9 m ³ /day.

During construction, a leak-proof septic basin will be built for the disposal of domestic wastewater. Wastewater generated during the construction phase will be collected in the septic tank and disposed in accordance with Water Pollution Control Regulation. The domestic wastewater generated during the construction phase will not create any adverse impact on the local environment. The Project will comply with the Turkish Water Pollution Control Regulation and the IFC Guidelines.

5.3.2 Operation

During operation period the Project will not need process water. Thus, the Project will not have any adverse impact on the local water resources. Drinking water demand of workers will be supplied with bottled water, whereas potable water could be supplied from the water network of the municipality or groundwater. In case the potable water demand of personnel is supplied from the groundwater resources, necessary permit will be secured from the State Hydraulic Works. Seven (7) employees, who will work at the site, will generate an average of 1.5 m³/day of domestic wastewater (0.150 m³/person/day x 7 persons = 1.05 m³/day). Wastewater will be collected in the septic tank and disposed periodically by local municipality. The proposed Project will comply with the Turkish Water Pollution Control Regulation and the IFC Guidelines and will not have any negative impact on the local environment.

5.3.3 Decommissioning

During decommissioning phase, potential impacts of water supply and wastewater are likely to be similar in scale to those associated with construction and an adverse impact is not expected.

5.4 Hazardous Waste

5.4.1 Construction

Small amounts of hazardous wastes such as oily rags, spent solvents, empty paints cans, chemical containers, waste oil and waste batteries and accumulators will be generated during the construction phase. Liquid hazardous wastes within the construction site will be collected in the leak-proof and safe containers and stored in an area with a concrete surface and a proper secondary containment to prevent potential spills and leakages reaching to the soil and groundwater. These containers will be properly labeled and this label will also indicate the amount of stored waste as well as the storage time of the hazardous waste. Waste oil will not be mixed with the other types of hazardous wastes and stored in red colored leak-proof containers with a label of "Waste oil" on it. These containers will be placed on impermeable ground and a proper secondary containment will be also provided for these waste oil containers. Transportation of the wastes will be done by the persons and entities that are licensed for this work and by the vehicles appropriate for the properties of the transported waste. The hazardous wastes will be sent to a licensed disposal facility. All health and safety precautions regarding for staff responsible for activities such as transport and temporary storage of wastes will be taken in the facility.

Waste battery and accumulators generated within the construction site will be collected separately from household wastes and will be delivered to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities within six months after they are generated.

The proposed Project will not create any adverse impact on the local environment due to the handling, storage, transport and disposal of the hazardous waste generated during the construction and will comply with the requirements of the Turkish Regulations and the IFC Guidelines.

5.4.2 Operation

Transformers not including carcinogenic materials will be used during the operation period of the Project. Waste oil will be generated due to periodical maintenance of the turbines. Waste oils will be stored red colored tanks/ containers with a label of "Waste Oil" on it and these containers will be placed at the areas with secondary containment. These wastes will be removed to a licensed disposal facility by licensed transporters. It should be noted that regular maintenance of the turbines will minimize the potential for fluid leaks. In addition, non-hazardous fluids will be used as much as possible and practicable.

In addition to the waste oils, waste battery and accumulators will be generated during operation. These wastes will be collected separately from household wastes and will be delivered to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities within six months after they are generated.

The hazardous wastes will be handled, stored, transported and disposed of according to the Turkish Hazardous Wastes Control Regulation, Waste Oils Control Regulation and Waste Batteries and Accumulators Control Regulation, and the IFC guidelines. Thus, an adverse impact on the local environment is not expected.

5.4.3 Decommissioning

During decommissioning, transformer oil and lubricating oil will be collected and stored on site as required by the Waste Oil Control Regulation prior sending them to a licensed company with licensed vehicles. Any hazardous waste generated during decommissioning will be stored on site temporarily until they are sent to the licensed treatment and disposal facilities. None of the hazardous waste will be left on site permanently.

5.5 Non-Hazardous Solid Waste

5.5.1 Construction

During the construction period, the following non-hazardous solid waste is expected to be generated:

- Recyclable solid wastes generated by workers (e.g. paper, glass, plastics, etc.);
- Organic solid wastes generated due to catering services provided for the employees;
- Construction wastes;
- Empty drums, cans, containers, etc. (according to the Turkish regulations, if they are used to contain hazardous chemicals, then the containers are considered as hazardous waste); and
- Scrap metal, packing material and card boxes, wood and timber scraps.

According to Turkish Statistical Institute Regional Statistics (2006), waste generation rate per person in İzmir Province is 1.06 kg/day/person. Thus, for 46 employees, daily total solid waste generation is estimated to be 48.76 kg/day.

Recyclable wastes like cement bags, metal scraps, packing boxes and wooden crates, etc. will be segregated from other wastes and stored temporarily on site for eventual recycling process. Any other solid wastes that are non-recyclable and non-hazardous will be collected within closed bags and these wastes will be transported to the disposal area of local municipality. All solid non-hazardous wastes will be treated according to the Solid Waste Control Regulation, Packaging Wastes Control Regulation and the IFC guidelines.

Excavated soil will be re-used for the filling of the turbine foundation and site leveling purposes. Hence, no excavated soil will be transported and stored outside the Project site.

5.5.2 Operation

During operation phase of the power plant, the only domestic solid wastes will be generated from people working at the plant. Based on 1.06 kg/person/day average output, the daily total output is expected to be $1.06 \text{ kg/person/day} \times 7 = 7.42 \text{ kg/day}$.

Such solid wastes will include food leftovers, plastics, glass, etc. The paper, plastic and glass content in the wastes will be segregated from other wastes for recycling.

Similar to construction phase, non-recyclable and non-hazardous solid wastes will be collected within closed bags and these wastes will be transported to the disposal area of local municipality. The Project will comply with the Turkish Solid Waste Control Regulation and the IFC Guidelines when handling, storing and disposing of non-hazardous solid waste.

Adverse environmental impacts associated with solid waste is not expected during the operations.

5.5.3 Decommissioning

During the decommissioning, similar to construction and operation period, non-hazardous waste will be segregated and non-recyclables waste will be taken to the local municipal disposal area. The recyclables waste will sent to the licensed and authorized recycling companies. Adverse environmental impact is not expected during decommissioning.

5.6 Medical Wastes

It is not planned to construct infirmary at the Project site within the scope of the Project. The closest health care center will be used for health care purposes. Hence, no medical waste will be generated at the Project site during the construction and operation phase.

5.7 Soil and Groundwater

5.7.1 Construction

Construction activities may pose the potential for release of petroleum based products, such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. In order to minimize spill risk, all chemical storage containers, including diesel fuel, and hazardous liquid waste drums/containers will be placed so as to minimize the risk of soil and groundwater contamination and water pollution. Such chemicals and fuel will be stored in concrete areas with proper secondary containments and drip trays during construction. When necessary, spill kits, absorbent pads or materials and absorbent sands will be provided near the chemical storage areas at all times.

There is also a potential for spills/leakage of oil associated with the construction machinery and vehicles. Construction machinery will be checked regularly. Any maintenance required will occur over hard standing or on a suitable impermeable ground cover. Refueling will be limited to a designated area. Spill kits, absorbent pads and absorbent sands will be available on site at all times. Parking of staff vehicles will only be permitted in designated areas.

Any spills will be cleaned up as soon as possible with any contaminated sands bagged up and disposed of correctly.

With such proper precautions to prevent potential releases to reach environment, an adverse impact to soil or groundwater is not expected during the construction.

5.7.2 Operation

It is not expected to store large volumes of chemicals and oil during the routine operations. Only some minor and temporary storage of transformer and lubricating oil will take place during the routine maintenance. All storage tanks and drums, including those containing oil will be placed in concrete areas with proper secondary containments.

Most of the oil is contained in the gearbox and any leakage would be contained within the nacelle and tower structures. The turbines will be designed with fluid catch basins and containment systems to prevent accidental releases from leaving the nacelle. The door to the tower is situated above ground level. Any accidental gear oil or other fluid leaks from the wind turbines will be contained inside the towers as they are sealed around the base and will be cleaned up as soon as possible. The wind turbines will be equipped with sensors to automatically detect loss in fluid pressure and/or increases in temperature in the lubricating oils used, enabling the turbines to be shut down automatically in the event of a fluid leak.

Transformers will be sealed units with negligible leakages. The transformer oils will not contain polychlorinated biphenyls (PCB).

With these precautions to prevent potential releases from reaching the environment, an adverse impact to soil or groundwater is not expected during the operations phase.

5.8 Biological Resources

The proposed Project is not expected to create significant impacts on the local biological resources and wildlife on or in close proximity to the Project site. Indirect but not significant habitat loss as a result of increased human presence, noise or the movement of the operating turbines is anticipated.

5.8.1 Protected Areas

There are no national parks, natural parks, natural monuments, natural protection areas, wildlife protection areas, wildlife improvement areas, tourism regions, tourist sites and tourism centers within the Project site and its close vicinity as declared in accordance with the Turkish national legislation. As indicated in the Section 4.10, part of the Foça Special Protected Site, which is located approximately 13 km to the Project site, was registered as the 1st and 2nd Degree Nature Protection Area. No impact is expected on these areas due to the proposed Project.

There will be impact on the existing vegetation during site preparation and excavation activities. However, vegetation loss will be limited and moreover, topsoil will be removed and stored on site for future landscaping purposes. Since the Project area is dominantly covered by shrubs, minor tree cuttings will occur during construction activities. As a result the impact on vegetation is expected to be not significant during the construction.

5.8.2 Bird Collision Risk

The most important potential impact of the Project is the risk of collision of birds and bats with the wind turbines. Some resident birds might fly over the Project site during their daily usual flights. As explained earlier in Section 4.9, the Project site is not located on a migration route, thus migratory birds are not of concern for potential collision risk. However, the Project site is located near the northern borders of the Foça Peninsula IBA. Although, the Project is located within Foça Peninsula IBA, as indicated in Section 4.3, the Project site is located in the close proximity of the heavily industrial zone. Thus, activities and noise arising from current industrial facilities in the area most likely affect birds not to prefer this area as a potential habitat. Mitigation measures against bird collision are provided in following paragraphs.

Studies of bird behavior around wind turbines have shown that when the turbines are visible, birds will change direction to avoid flying directly into turbines. In addition, water birds such as geese and swans tend to avoid the vicinity of turbines, keeping from 250 m to 500 m away from them (NWCC, 2002).

There are a number of studies available in the literature about avian collisions with wind turbines. It is reported that fatality rates of birds vary among sites and likely depend on several factors including the amount of bird, vegetation, and other physical and biological characteristics of the specific wind plant and surrounding area (NWCC, 2004).

It is reported in a study published by National Wind Coordinating Committee (NWCC) that the avian mortality result from the collisions with human-made structures, including vehicles, buildings and

windows, powerlines, communication towers, and wind turbines (NWCC, 2001). The study indicates the following estimated annual avian collision mortality in the United States:

- Vehicles: 60 million - 80 million
- Buildings and Windows: 98 million - 980 million
- Powerlines: tens of thousands - 174 million
- Communication Towers: 4 million - 50 million
- Wind Generation Facilities: 10,000 - 40,000

As seen from the list above, the lowest rates of avian mortality in the United States are estimated to result from the collisions with the wind turbines. It is reported that data collected to date indicate an average of 2.19 avian fatalities per turbine per year for all species combined and 0.033 raptor fatalities per turbine per year in the U.S. Based on the projections of 15,000 operational wind turbines in the U.S. by the end of 2001, the total annual mortality was estimated at approximately 33,000 bird fatalities per year for all species combined. The majority of these fatalities are projected to occur in California where approximately 11,500 operational turbines exist, and most are older smaller turbines (100- to 250-kW machines) (NWCC, 2001).

Consequently, based on the estimates in the report, wind turbine-related avian collision fatalities probably represent from 0.01% to 0.02% (i.e., 1 out of every 5,000 to 10,000 avian fatalities) of the annual avian collision fatalities in the United States (NWCC, 2001). Large number of fatalities is reported at large wind farms, such as Altamont wind farms located in California which has over 5,000 turbines. Bird fatalities are significantly lower if the wind farm has less number of turbines.

Although the chance is low, there still exists a risk of avian collision with the wind turbines and hence necessary precautions must be taken to minimize this avian collision risk. The mitigation measures to minimize avian collision risk associated with the proposed Project are explained in the following section.

Mitigation Measures

Since the Project will include only 4 turbines, it is anticipated that the risk of avian mortality due to collision with the turbines will be relatively and significantly lower than large wind farms.

In order to reduce potential avian collisions during the operation following measures will be taken:

- Micrositing: Sufficient distance, ranging from 360 m to 500 m, is placed between two turbines; thus birds should be able to fly around or above turbines.
- Appropriate storm water management measures will be implemented to avoid creating small ponds which can attract birds and bats for feeding or nesting near the wind farm.
- Turbine blades will be painted by reflecting color and appropriate lighting of the wind turbines will be provided. As indicated in the above, according the studies regarding bird behavior around wind turbines, when the turbines are visible, birds will change direction to avoid flying directly into turbines. Hence, collision risk will be reduced.

5.9 Cultural and Historical Resources

As indicated in Section 4.11, there are no archaeological and historical resources within the proposed Project site. The closest archaeologically protected sites to the proposed project sites are can be listed as;

- Nameless 3rd Degree Archaeologically Protected Site located approximately 0.5 km to the Turbine 3 (T-3); and
- Nameless 1st Degree Archaeologically Protected Site located approximately 1.2 km to the Turbine 3 (T-3).

In addition to these archeologically protected sites mentioned above, Kyme Ancient City which was registered as Kyme Ancient City 1st Degree Archaeologically Protected Site by the Council of Cultural and Natural Heritage Preservation Board on September 30, 1996 is located approximately 3 km to the closest Turbine T-1. Kyme Ancient city is located in a close proximity of the petrochemical complex.

Although there are no archeological and historical resources within the proposed Project site, there is always a chance of discovering archeological artifacts or remains during construction related excavations in Turkey. During construction, if any archeological remains are discovered, as the national law requires, the Project will cease excavation at this location and inform the local Department of Culture and Tourism immediately. After inspection by the experts from the local Department of Culture and Tourism, a decision will be given to continue or reposition the excavation. With these precautions, the local cultural and historical resources will not be adversely impacted due to the construction activities.

5.10 Visual Impacts

Visual or aesthetic resources refer to those natural and cultural features of an environmental setting that are of visual interest to people. The Project site is not located in a protected area or a tourist/resort area; it is located on a hill top and not considered as an aesthetically significant place. Thus, a visual impact is not considered as significant. However, the visual impact associated with the proposed wind farm will be permanent for those residing at the closest settlements.

The potential visual impact of the proposed wind farm will primarily result from changes to the visual character of the area within the view catchment. The nature of these changes will depend on the level of the visual contrast between turbine structures and the existing landscape within which they would be viewed. The degree of contrast between the turbines and the surrounding landscape will result from one or more of the visual characteristics such as; color, shape or scale, texture and reflectivity. Since the Project site has a hilly topography and the closest settlements are located at lower elevations, the turbines will be viewed against the sky.

In order to demonstrate the visual impact, views of the Project site from three different locations have been prepared. Three dimensional models were used in order to represent wind turbines, towers and blades and these models were located on satellite image of the Project site. The

dimensions of the models were same as the Project dimensions; 85 m hub height and 100 m rotor diameter.

- The first view, which is given in Figure 5-5, is looking to the Project site from Çakmaklı Village in north-northeast direction, about 800 m away from Turbine 4 (T4) at 26 m altitude.
- The second view in Figure 5-6 shows the Project site from İzmir-Çanakkale State Road situated in the east of the project site. The view is looking in west-southwest direction, about 3 km away from Turbine 3 (T3) at 12 m altitude.
- The last view, shown in Figure 5-7 is looking to the wind farm from east of YeniFoça Town in west looking in east-northwest direction, about 4.5 km away from Turbine 2 (T2) at the altitude of 5 m.



Figure 5-5 View of the Project Site from Çakmaklı Village

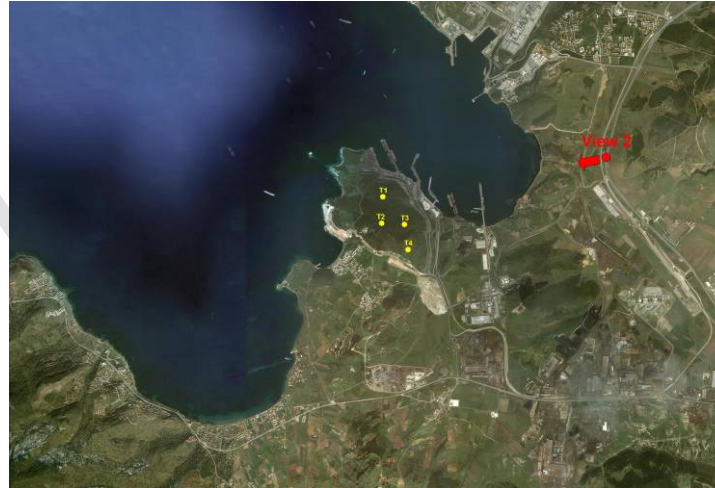


Figure 5-6 View of the Project Site from İzmir-Çanakkale State Road

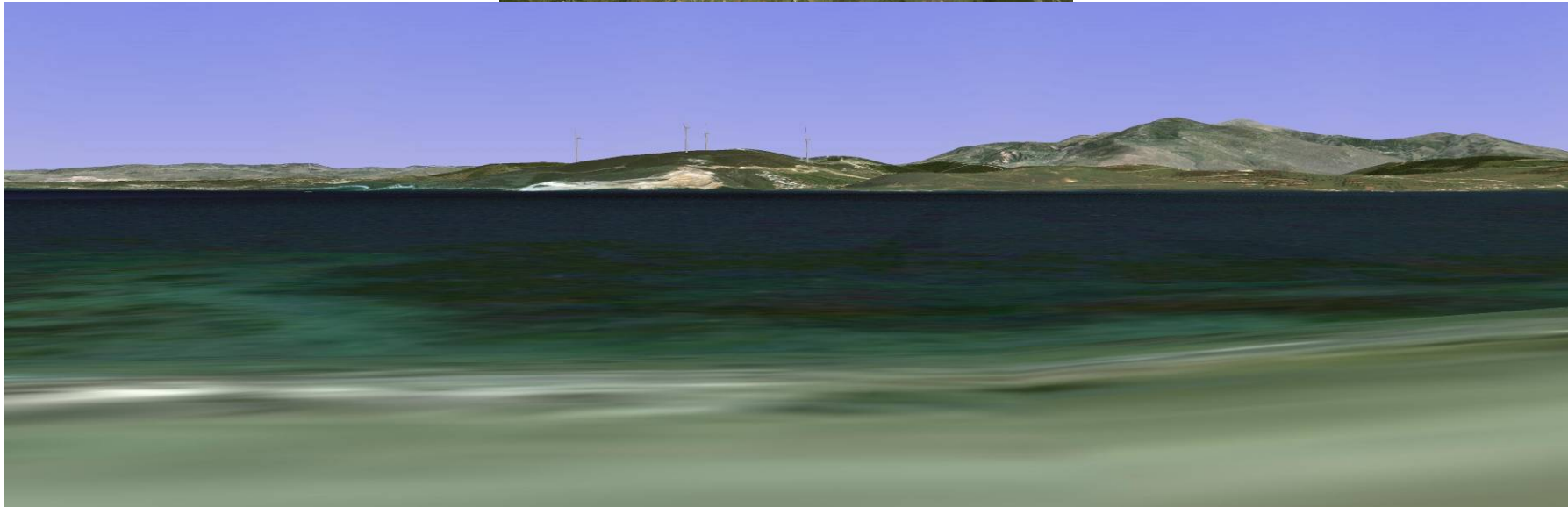
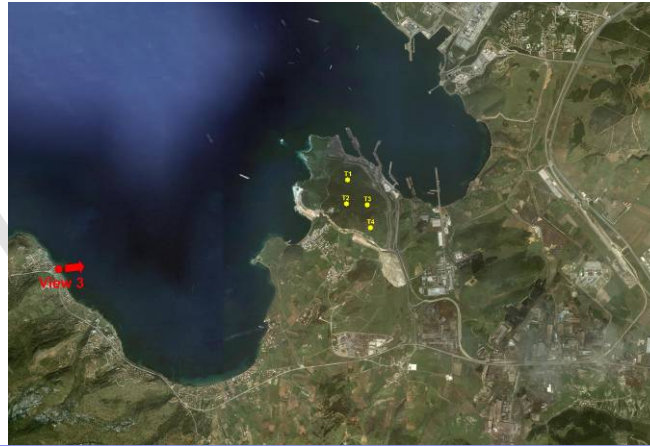


Figure 5-7 View of the Project Site from East of YeniFoça Town

As can be seen in Figure 5-5, all turbines will be seen from the View Point 1, which is located at Çakmaklı Village. Since T1 is farthest turbine to the View Point 1 at the north of the Project site, it will be partially seen with its rotating blades and nacelle. The turbines will be in the view shed of the drivers navigating on İzmir-Çanakkale State Road passing from the east of the Project site as shown in Figure 5-6. In the last view (Figure 5-7) from the east of Yeni Foça Town situated in the west of the Project site, all turbines will be visible to the residents.

Visual impact is a subjective issue, a significant number of people in Turkey associate wind farms with clean energy and view the towers as symbols of modern and civilized living. There is no known public opposition on wind farms in terms of potential visual effects. Moreover, after the conversations with local people, it was understood that they do not have any disturbance or negative attitude about the visual impact of wind towers. Thus, it is expected that public and NGOs will view this development favorably and visual impacts will not be considered as significant.

5.11 Shadow Flicker and Blade Glint

Wind turbines, like all other tall structures will cast a shadow on the neighboring area when the sun is visible. The major difference between a tall structure and a wind turbine regarding their shadow casting potential is the rotating blades of the wind turbine. As the rotor blades rotate, shadows pass over the same point causing an effect termed as shadow flicker. Shadow flicker occurs when the sun passes behind the wind turbine and thus casts a shadow. This phenomenon is regarded as an environmental impact and can create a disturbance/nuisance if the wind farm is not situated and/or planned accordingly.

A modeling study was performed in order to estimate the shadow casting areas by WindPRO software and to create a shadow model for each of the wind turbines. Two shadow receptors which are closest permanent residences are determined. The map showing location of shadow receptors is given in Figure 5-8. As can be seen in Figure 5-8, the Shadow Receptor 1, which is the same residence selected as noise sensitive receptor, is located in northeast of the summer houses situated in the north of Çakmaklı Village in west of the Project site. The Shadow Receptor 2 is located in the south of the Shadow Receptor 1 in the summer houses in the west of the Project site.

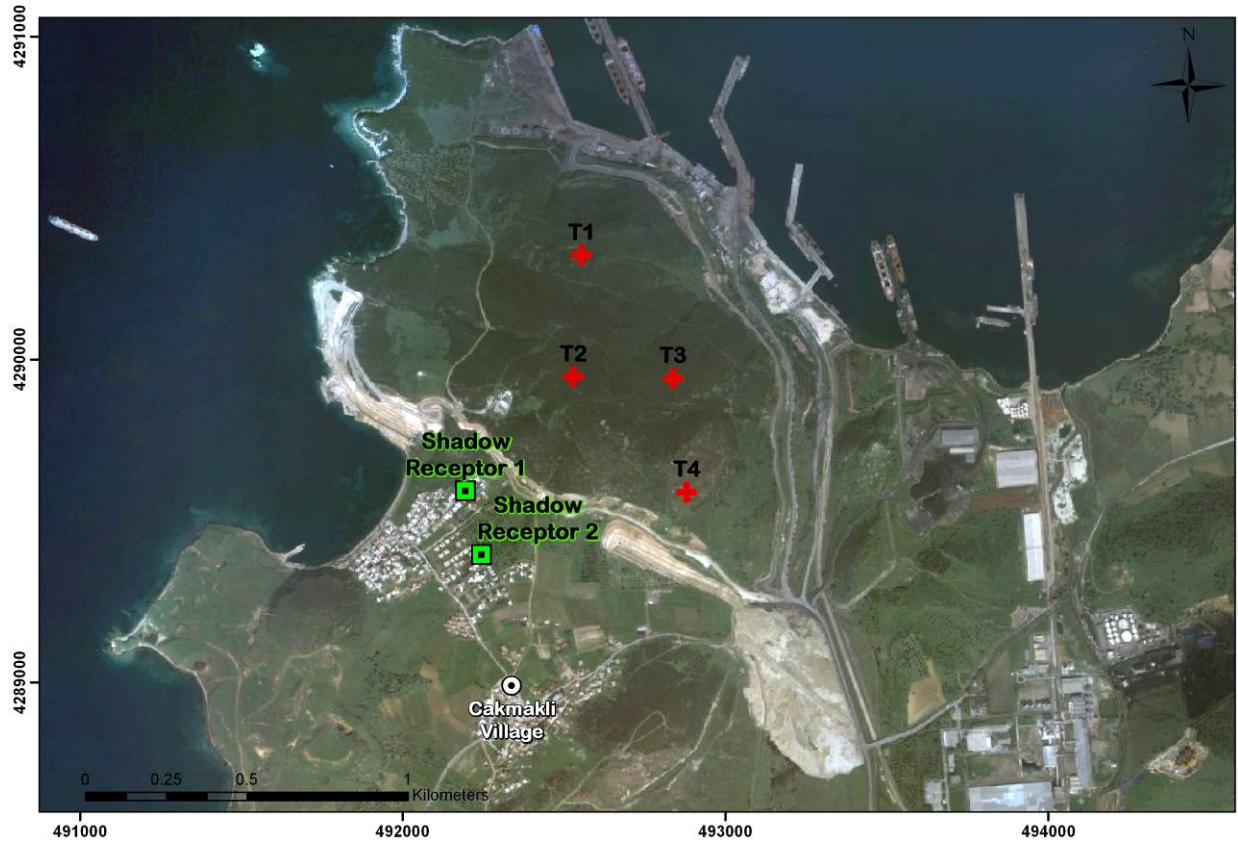


Figure 5-8 Locations of Shadow Receptors

The coordinates of the shadow receptors (UTM Projection, ED 50 datum) are given in Table 5-8 below.

Table 5-8 Shadow Receptor Coordinates

	East	North	Z
Shadow Receptor 1	492,195.83	4,289,592.57	22.8
Shadow Receptor 2	492,245.32	4,289,395.20	16.0

Model Inputs

Shadow module of WindPRO software requires several parameters for the calculation of the shadow model. These parameters are terrain data, blade specifications (shape, length, thickness etc.), sun shine probabilities for each month, annual operational times of turbines for each of 16 wind sectors, maximum distance of influence, and minimum sun height over horizon for influence.

Terrain data used in the model is 10 m contour data which provides accurate elevation values for both turbines and shadow receptors. Blade specifications values are obtained from known values of similar size blades given in database of WindPRO software. In addition, a hub height of 85 m and rotor diameter of 101 m are entered into model. Monthly sun shine probability values are acquired

from long term meteorology data (1984-1991) of Aliğa Meteorological Station. Annual operational times of turbines for each of 16 wind sectors are obtained from data from MAST towers situated in the Project site. Monthly sun shine probability values and annual operational times for each of 16 wind sectors are given in Table 5-9 and Table 5-10, respectively.

Table 5-9 Monthly Sun Shine Probabilities

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Probability	0.065	0.057	0.106	0.1	0.25	0.5	0.69	0.7	0.6	0.2	0.1	0.07

Table 5-10 Annual Operation Times for 16 Wind Sectors

	N	NNE	NE	ENE	E	ESE	SE	SSE
Hour (hr)	144.03	587.46	1,561.06	632.22	90.32	145.42	420.55	573.93
	S	SSW	SW	WSW	W	WNW	NW	NNW
Hour (hr)	488.59	241.51	145.22	200.33	253.45	245.09	168.1	92.31

Regarding the maximum distance for influence of shadow flickering, various attempts and experiments have showed that the shadow impact is irrelevant at the areas which are seven times rotor diameter distance away from the wind turbine (windpower.org). Although the influence distance is 700 m according to this assumption, to be on the safe side, the distance of 1,575 m which is the maximum distance in the WindPro software shadow model is used as the maximum distance of influence for shadow flickering. The minimum sun height over horizon is used as 3° in the model.

Model Results

Shadow modeling calculates the shadow flickering impact in two different scenarios; worst case and realistic case. The worst case scenario assumes that the sun is shining for all day from dusk to dawn with no cloud cover and the heading of the turbines is following the movement of the sun during the shining hours. The realistic case scenario is based on the inserted data into the model such as; annual operation hours of turbines in 16 wind sectors and monthly sunshine probabilities.

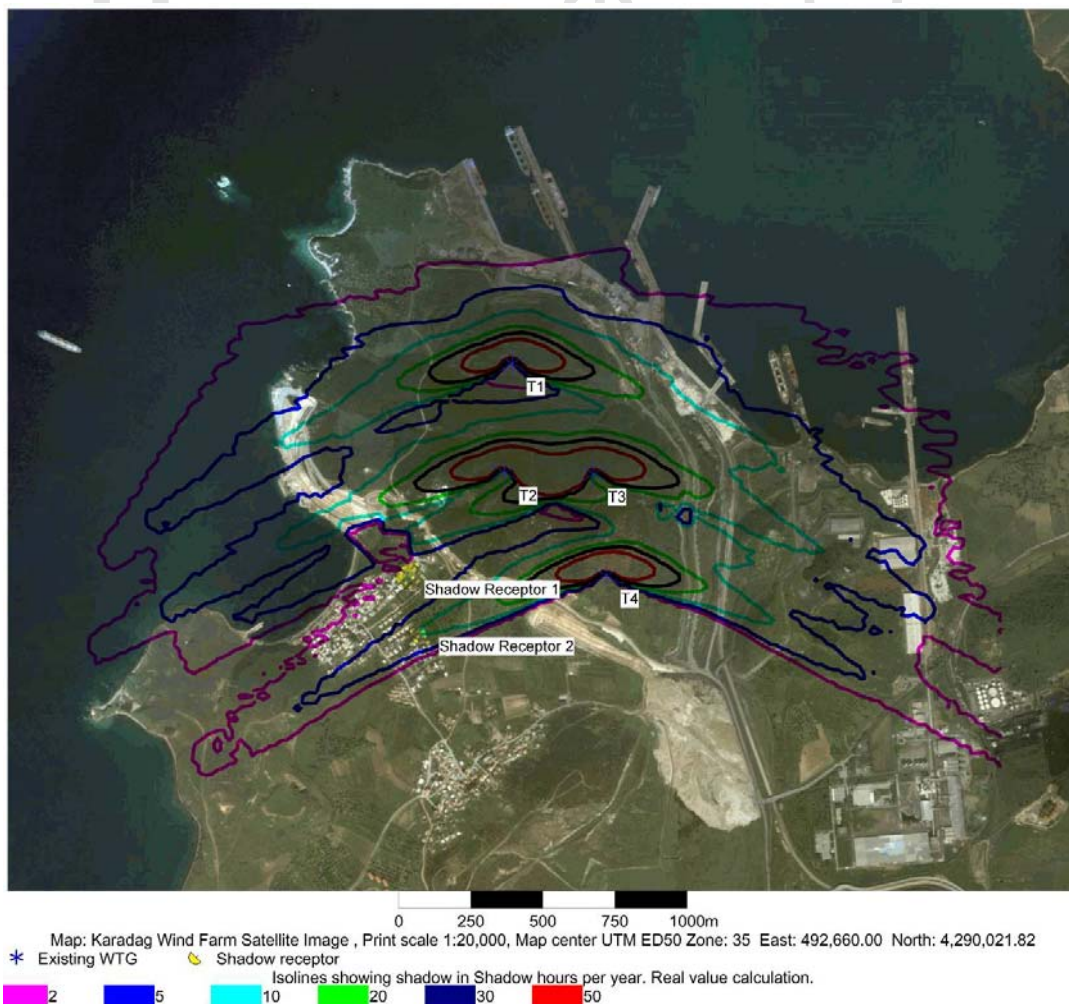
Shadow modeling calculates the shadow flickering for each minute of a day throughout a year. The results of WindPRO software include several reports and graphical demonstrations. These reports are given in Appendix B.

The summary of the modeling results are provided in Table 5-11. In this table, shadow hours per year at the shadow receptors for both worst and realistic cases are provided. The map showing the shadow contours (hour/year) for realistic case is given in Figure 5-9.

Table 5-11 Shadow Modeling Results for Shadow Receptors

	Shadow Worst Case			Shadow Realistic Case
	Shadow hours per year (h/year)	Shadow days per year (days/year)	Max. shadow hours per day (h/day)	Shadow hours per year (h/year)
Shadow Receptor 1	19:07	44	0:33	2:48
Shadow Receptor 2	46:26	89	0:36	10:22

Modeling results demonstrate that the shadow flickering that is observed at both shadow receptors will be caused by Turbine 4. In realistic case, Shadow Receptor 1 will observe total shadow for 2:48 hours in a year whereas 10:22 hours per year of shadow flickering will occur at the Shadow Receptor 2. In worst case scenario, Turbine 4 will cause shadow flickering at the Shadow Receptor 1 and Shadow Receptor 2 for 19:07 hr/year and 46:26 hr/year, respectively.

**Figure 5-9 Realistic Case Shadow Contour Map**

The shadow calendar graphs given in Appendix B show that shadow flickering at the Shadow Receptor 1 and Shadow Receptor 2 will be caused from Turbine 4. Shadow flickering at the

Shadow Receptor 1 will be observed during April and May within the hours of 7:30 a.m. to 8:30 am. Turbine 4 results in shadow flickering at the Shadow Receptor 2 at a longer duration than that of Shadow Receptor 1. Shadow flickering will be observed at the Shadow Receptor 2 during May, June and July within the hours of 6:45 am and 7:45 am.

There is no limit stated in both Turkish legislations and IFC/World Bank guidelines regarding to shadow flickering. The modeling result show that insignificant amount of shadow flickering will occur at the shadow receptors for both worst case and realistic case scenarios and it can be stated that the proposed wind power plant will not cause shadow flickering on the closest settlements. In addition, blade glint is not expected to be important since the blades will be made of and painted non reflective materials.

6.0 SOCIO-ECONOMIC IMPACTS

Potential impacts onto local socio-economy may arise during construction, operation and decommissioning phases of the Project. Probable socio-economic impacts and mitigation measures are described in the following sections.

6.1 Construction Phase

- Employment;

Impact: There might be employment opportunities during construction phase of the project.

Mitigation: A recruitment approach to hire construction workers from region and especially from project-affected communities will provide a positive socio-economic impact.

- Land Expropriation and Land Use;

As it was discussed in Section 4.0 of the ESA report, the Project area is located on a state-owned land. GARET has leased the required land for 49 years from the Ministry of Finance in accordance with the national energy law and regulations. Currently there is no active use of this land for any economic income purpose (such as for agriculture). Therefore, physical or economic resettlement will not be necessary for the proposed Project.

- Community relations;

Impact: There might be tension/dispute between local resident and workers during construction period.

Mitigation: This impact can be minimized by managing any disputes between the Contractors and local residents, showing respect to local people and customs, implementing an alcohol and drug policy for the construction workers, having zero tolerance of illegal activities by construction personnel, providing cultural awareness training to construction workers.

- Safety risk for local community;

Impact: There might be temporary increase in traffic flow in the region during construction.

Mitigation: In order to minimize the impact, local residents will be informed about the traffic flow.

Impact: Open trenches during construction of the Project might pose a safety risk to the local community.

Mitigation: There will be no access to open trench area for non-authorized personnel. The security guards will prevent access to non-authorized personnel to the construction area.

- Disruption to local infrastructure;

Impact: There might be disruption to roads during the construction of the Project.

Mitigation: All of the construction works are planned and managed properly to eliminate and minimize health and safety risks. Transportation and construction works will be done properly to minimize damage to local infrastructure.

6.2 Operation Phase

- Employment;

Impact: There might be employment opportunities during operation phase of the Project.

Mitigation: A recruitment approach to hire safety guards from region and especially from Project-affected communities will provide a positive socio-economic impact to the Project.

- Safety risk for local community;

Impact: Access of non-authorized people to high voltage parts and equipments might result in health and safety risks.

Mitigation: There will be safe guards during operation of the plant that will prevent access to high voltage parts and equipments. All of Project personnel will be trained for health and safety issues.

6.3 Decommissioning phase

The socio-economic impacts of the Project during decommissioning phase are similar to that of during construction phase. However, there might be some additional impacts due to change in the demography of the Project area at the time of decommissioning. Negative impacts should be minimized by taking necessary mitigations and compensations should be given when required. Positive impacts such as employment opportunity should be maximized by applying necessary policies and mitigations.

7.0 OCCUPATIONAL and COMMUNITY HEALTH AND SAFETY

7.1 Working at Heights

Working at height is a major occupational health and safety issue while assembly of wind tower components and general maintenance activities during operations. Prior to the construction works, a Health and Safety Plan (HASP) including issues relevant to working heights will be prepared and implemented. As the details will be included in the HASP, the safety harness will be used to secure persons during ascent to and descent from the nacelle of the wind turbine generator system and when carrying out work in areas where there is a falling hazard. In addition, employees will be trained in climbing techniques and fall protection measures and fall protection equipment will be inspected, maintained and replaced regularly. Furthermore, tower installation and maintenance works will not be carried out during poor weather conditions.

All the precautions related with working at heights will be taken throughout the construction and operational phases of the proposed project in accordance with the Turkish Health and Safety laws and regulations and IFC Guidelines. With the proper implementation of the HASP and taking the necessary precautions given in the regulations, potential accidents associated with working height would be eliminated.

7.2 Air Craft and Marine Navigation Safety

In accordance with the 2920 numbered Civil Aviation Law, it is forbidden to construct buildings and structures that will prevent air traffic, aviation security, and telecommunication and endanger the navigation and court security around the airports and related facility or equipments. In addition, according to the Regulation on Construction, Operation and Certification of Airports published in the Official Gazette No. 24755 dated May 14, 2002, Ministry of Transport and Communication was authorized to remove buildings and structures that will endanger the aviation safety. In addition, Ministry of Transport and Communication could ask putting visible signs and radio and electrical signs on the defined obstacles and areas.

International Standards and Recommended Practices (Annex 14) published by the International Civil Aviation Organization (ICAO) recommends that the obstacles or fixed objects listed below should be marked or lightened according to the defined methods;

- A fixed obstacles that extend above a take off climb surface within 3,000 m of the inner edge of the take-off climb surface;
- A fixed object, other than a obstacles adjacent to the take-off climb surface;
- A fixed obstacles that extends above an approach or transition surface within 3,000 of the inner edge of the approach surface;
- A fixed obstacle above a horizontal surface; and
- A fixed object that extends above an obstacle protection surface.

Proposed Project area is located approximately 54 km north-west of the Adnan Menderes Airport and 28 km north-west of Çiğli Military Airport. Hence, in accordance with the recommendations published by ICAO, there is no need to mark or lighten the wind turbines. However, in case visible signs and radio and electric signs are requested by the Ministry of Transport and Communication, the wind turbines should be marked.

As indicated in the previous sections, in the scope of the Project two wind masts were installed in the proposed Project area. Project site is located within the boundaries of İzmir Regional Directorate of Forestry. İzmir Regional Directorate of Forestry requested red colored reflecting balls to be placed at the wind towers located within the boundaries of their regional directorate since this region had a high risk of forestry fires and fire planes and helicopters had been used intensely. For Karadağ Wind Power Project, the related official letter was sent by the Akhisar Operation Directorate of Forestry and requested to place red colored reflecting balls at wind masts. GARET indicated that placing these reflecting balls would be negatively affect stability of the wind masts and suggested to paint the entire wind mast with red and white colors in 6-meter width and place lightening system at the top of the towers. In response to this letter, it was indicated by the İzmir Regional Directorate of Forestry that there is no objection to this application. Similar to wind masts, in order to provide aviation safety the edges of the turbine blades will be painted by a reflecting color and lightening system will be installed. In the scope of the proposed Project, 2920 numbered Civil Aviation Law and related international laws will be complied with.

7.3 Blade/ Ice Throw

As indicated in Section 3.1, the coldest month is January when the average minimum temperature is 8.1°C. Since, in general the Mediterranean Climate is dominant in the region; blade/ice throw will not be a potential risk to threat public safety.

7.4 Electromagnetic Interference

Wind turbines could lead electromagnetic interference with aviation radar and telecommunication systems. According to Federal Aviation Administration (FAA); for Air Traffic Control radar the electromagnetic interference is generally limited to wind turbines that are within the radar line of sight. Studies conducted by the FAA indicate that interference problem may be minimal for turbines more than 5 nautical miles (i.e. $5 \times 1,852 \text{ m} = 9,260 \text{ m}$) from the radar. The closes radar is located approximately 28 km to the Project site. Hence, no interference problem is expected with the radar. In addition, wind blades are made of synthetic light material which will reduce the impacts of electromagnetic interference caused by wind turbines. The proposed Project is not expected to interfere with the telecommunication systems.

7.5 Public Access

The proposed Project will not cause any risk in terms of public access. All the necessary precautions will be taken in order to prevent un-authorized access to Project site. There will be 2 security personnel during the operation period. Hence, entrance of unauthorized people to the wind turbine area will be prevented.

8.0 ANALYSIS OF ALTERNATIVES

8.1 Technology Alternatives

Power plants can produce electricity using a renewable resource, such as water, wind or solar, or a nonrenewable resource such as coal, oil/gas or nuclear energy. Coal fired or gas fired thermal power plants are generally built as close as possible to their fuel resources or close to their transportation routes.

The coal fired or oil/gas fired thermal power plants have high air emission rates although their stack air emissions are significantly reduced by modern treatment technologies. In thermal power plants, various types of hazardous wastes are generated due to their processes. Thermal power plants generally require a considerable amount of water for their cooling systems, which creates another environmental problem to overcome.

Hydropower plants are constructed at the main tributaries of rivers. These projects occupy significantly large surface areas due to the water reservoir created behind the dams. Thus, impacts on biological resources, wildlife and natural habitat are generally considered significant during the construction and operation of hydro power plants.

Wind power is a renewable power source as it only uses the movement energy of the air currents for power production. Here are some advantages of wind power:

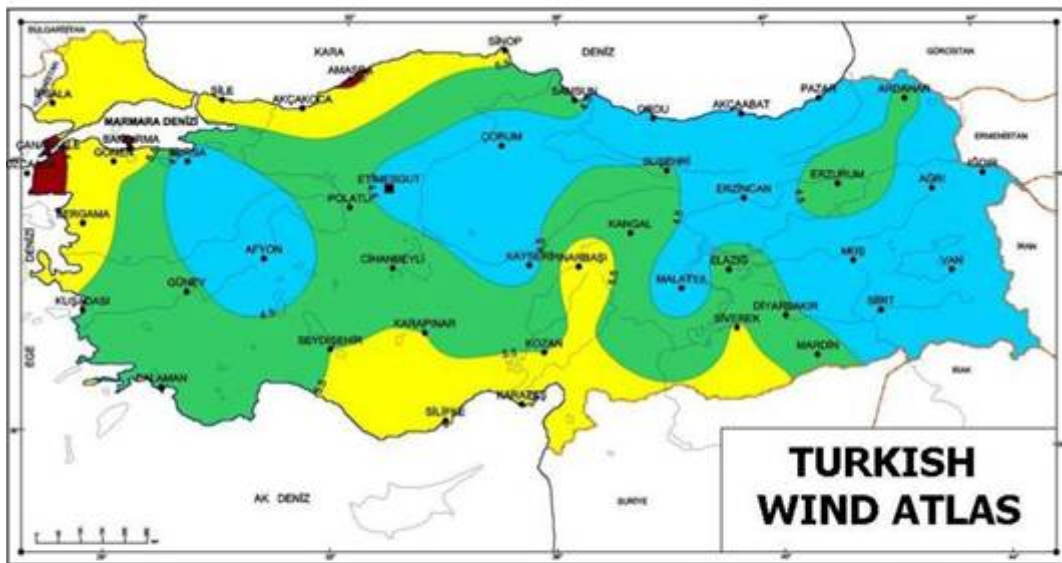
- Wind facilities produce electricity without requiring the extraction, processing, transportation, or combustion of fossil fuels.
- Wind power production is an environmentally friendly power generation source, as it does not produce any air emissions or hazardous wastes.
- Unlike fossil-fueled power plants, wind farms emit no greenhouse gases.
- Wind project operation does not consume surface or groundwater, or discharge wastewater containing heat or chemicals.
- Wind turbines take up less space than the average power station. Windmills only have to occupy a few square meters for the base. This allows the land around the turbine to be used for many purposes, for example agriculture.
- Wind turbines are a great resource to generate energy in remote locations, such as mountain communities and remote countryside. Wind turbines can be a range of different sizes in order to support varying population levels.
- The wind power generation industry has a proven record of safety. Accidents related to wind power are reported to occur only during construction and maintenance.

In addition to the advantages of wind power, wind power generation has been recommended that due to the limited fossil fuel resources, a gradual shift from fossil fuels to renewable resources should be considered seriously in Turkey (Ediger and Kentel, 1999).

As stated in previous paragraphs there are various technical alternatives of producing electricity from different energy resources. However, in order to combat with the global warming problem, sustainable and renewable energy resources must be used as much as possible. The Project aims at utilizing wind energy, which is a renewable energy, potential of Turkey via Wind Turbine technology to generate electricity. Hence, the Project will not only provide benefit to Turkey by producing electricity but also to global atmosphere by reducing CO₂ emissions.

8.2 Alternative Sites

The General Directorate of Electrical Power Resources Survey and Development Administration (EPRSDA) evaluated the natural wind energy potential for most parts of Turkey using monthly wind speed and direction data from the State Meteorological General Directorate. As a result of these studies, Turkish Wind Energy Potential Atlas presented in Figure 8.1 had been prepared in order to evaluate the wind energy potential (REPA, 2007). The figure has been created by WAsP model based on the collected wind data at several locations around Turkey. As seen in the figure, the region where proposed Project site is located is marked with yellow and this means the average wind speed in the region is between 5.5 m/sec and 6.5 m/sec. The Project Site is selected in this region in order to utilize high wind energy potential in this region. Additionally, on site collection of wind data on the project site by GARET for two years also demonstrated this high wind energy potential in the Project area.



Wind resources at 50 m above ground level for open plains (roughness class 1)

v (m/s)	> 7.5	6.5 – 7.5	5.5 – 6.5	4.5 – 5.5	< 4.5
P (W/m²)	> 500	300 - 500	200 - 300	100 - 200	< 100

Figure 8-1 Wind Atlas for Turkey

(Source: Turkish Wind Atlas, State Meteorological Organization, 2002)

9.0 ACTION PLAN AND MANAGEMENT SYSTEM

Project Action Plan (AP) provides clearly identifiable mechanisms to ensure that all mitigation measures recommended in the ESA are implemented.

Table 9-1 comprises the AP including environmental and social issues for the Karadağ Wind Power Plant. In preparing the AP consideration has been given as appropriate to the IFC's Policy and Performance Standards on Social and Environmental Sustainability. AP and the environmental and management plan are based on the mitigation that is considered necessary to reduce or avoid the potential significant impacts of construction, operation, and decommissioning on environmental and human receptors. GARET, its subcontractors, and its workers should comply with the recommended construction and operational practices and mitigation measures described in the table to ensure that their activities are conducted in a manner that meets the environmental protection requirements of the AP. This would include training for workers so they are familiar with the practices required by the AP. The proposed AP can be regularly updated as the works progress through the different phases and as environmental and social issues associated with the project change in significance.

In addition to the ESA and AP, other documents such as the construction Health, Safety and Environment (HSE) Plan and the Operations Environmental Management System (EMS) should be prepared at a later date and should include further details on the manner in which the aims of the AP will be implemented.

The costs associated with the proposed mitigation for the Project should be minimal and are inherent to good engineering practice. There are not considered to be any site specific mitigation measures that could represent a significant expense. Monitoring costs would be minimal and would principally be associated with the purchase of monitoring equipment and the employment of the relevant environmental staff or consultants.

To ensure that the monitoring and mitigation measures outlined in the AP are successfully implemented consideration of the appointment of an environmental and safety Engineer during the construction and operational phases should be considered.

The Engineer would need to be designated by the project developer who would be responsible for the implementation of the AP. The Engineer would be responsible for reporting on any oil spills etc, and for ensuring AP and permitting requirements are met, as well as ascertaining adequate reporting of events. The compliance or non-compliance as results from inspections would need to be documented by the Engineer, who would be in consultation with the Ministry of Environment and Forestry and relevant governmental agencies as required.

Employees/contractors engaged in the works would be expected to comply with the AP by their direct managers, who would be familiar with the AP and would liaise with the responsible Engineer.

In the event of an environmental incident, the point of contact would be the responsible Engineer. The responsible Engineer would use the incidents register and should report all incidents to GARET within 48 hours. Any serious incidents should be reported as soon as practically possible.

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ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
WATER AND SOIL QUALITY - Construction Phase						
Groundwater, Surface water and Soil Contamination	Moderate	Any wastewater discharge to the environment will be prohibited.	Contractor	Visual inspection	Continuously	Part of best working practice
	Moderate	All chemical storage containers, including diesel fuel, and hazardous liquid waste drums/containers will be placed in concrete areas with proper secondary containments during construction. When necessary, absorbent pads or materials will be provided near the storage areas.	Contractor	Visual inspection	Weekly	Part of best working practice
	Low to Moderate	Sanitary wastewater from the workers camp will be stored in sealed septic tanks.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	Weekly	Part of best working practice
	Low to Moderate	The septic tanks will be leak proof and will be checked periodically.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	Weekly	Part of best working practice
	Low to Moderate	Wastewater generated during the construction phase will be transported and disposed periodically by local Municipality.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	During the activity	Part of best working practice
	Low to Moderate	Siting and bunding of temporary fuel and oil stores will take into account proximity to water resources.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	Weekly	Inherit in Design
	Low to Moderate	An oil spill contingency plan will be prepared and implemented.	Contractor	-	-	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Low to Moderate	Spoil from construction activities will be monitored and controlled; waste materials which are unsuitable for reuse on-site will be disposed at an appropriately licensed sanitary landfill site.	Contractor	Visual inspection of construction grounds for potential stains	Weekly	Part of best working practice
WATER AND SOIL QUALITY - Operation Phase						
Groundwater, and Soil Contamination	Moderate to High	All chemical storage tanks and drums, including those containing fuel and oil as well as waste oil drums and containers will be placed in concrete areas with proper secondary containments. If necessary, absorbent materials will be purchased and placed near the chemical storage tanks.	Operator	Visual inspection to ensure the effectiveness of the mitigation measure	Daily	Part of best working practice
	Moderate to High	Any leakage oil will be collected in the bottom part of the nacelle enclosure. The wind turbine generator system will also be equipped with a series of smaller oil collection systems for individual system components.	Operator	Visual inspection to ensure the effectiveness of the mitigation measure	Daily	Inherit in Design
	Moderate to High	Any residues and leftover oil following maintenance work will be collected in leak-proof containers and removed to a recycling facility by licensed transporters.	Operator	Visual inspection to ensure the effectiveness of the mitigation measure	During the activity	Part of best working practice
	Moderate to High	Regular maintenance of the turbines will minimize the potential for fluid leaks.	Operator	Visual inspection to ensure the effectiveness of the mitigation measure	Daily	Part of best working practice
	Moderate to High	Transformers will be provided with pits to retain 110% of the coolant capacity of the transformers.	Operator	Visual inspection	When required	Inherit in Design
	Moderate to High	The cooling oil for the transformers will not contain PCBs or any other carcinogenic type oils.	Operator	Visual inspection	When required	Inherit in Design

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
Groundwater and Soil Contamination	Moderate to High	Waste oils will be temporarily stored, handled and disposed in separate tanks/containers according to the categories referred in the Waste Oil Control Regulation.	Operator	Visual inspection	When required	Part of best working practice
	Moderate to High	Waste oils will be collected inside the tanks/containers placed on an impermeable surface. Different tanks/containers will be used for waste oils of different categories. Waste oil temporary storage tanks/containers will be red and bear "Waste Oil" sign.	Operator	Visual inspection	When required	Part of best working practice
	Moderate to High	Emergency Response Plan and Oil Spill Contingency Plan will be prepared and implemented	Operator	-	-	Part of best working practice
Waste Oil Disposal	Moderate to High	Waste oils will be transported by licensed transporters to the licensed processing and disposal facilities and National Transportation Form will be filled in the case of transporting the waste oil out of the facility and waste oil declaration form will be submitted to relevant authorities annually.	Operator	Visual inspection	When required	Part of best working practice
Wastewater Disposal	Low	Wastewater generated during the operation phase will be transported and disposed by local Municipality.	Operator	Visual inspection	Monthly	Minimal
NOISE - Construction Phase						
Noise Control	Moderate	All construction vehicles will be maintained so that their noise emissions do not cause nuisance to workers or local people.	Contractor	Inspection with a Sound Meter	Daily or during the activity	Part of best working practice
	Moderate	Exhaust mufflers will be employed on engine-powered construction equipment and vehicles	Contractor	Inspection with a Sound Meter	Daily or during the activity	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Moderate to High	The use of vehicles during construction will be optimized as much as possible to reduce number of vehicles and thus reduce the potential for traffic noise.	Contractor	Daily inspection with a Sound Meter	Daily	Part of best working practice
Noise Control	Moderate	All vehicles will be driven responsibly and below 30 km/h within the construction site	Contractor	Daily inspection with a Sound Meter	Daily or during the activity	Part of best working practice
	Moderate to High	The site personnel will be provided with proper personnel protective equipments in order not to expose to high noise levels that can be generated at the site.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	Daily	Part of best working practice
	Moderate	Site personnel will be trained in the proper use and maintenance of tools and equipment, and the positioning of machinery on site to reduce noise emissions to neighboring communities.	Operator	Inspection to ensure the effectiveness of the mitigation measure	Weekly	Part of best working practice
	Moderate	The construction activities within residential areas and in the close vicinity cannot be carried out other than daytime frame (07:00-19:00)	Contractor	Visual inspection	Daily	Part of best working practice
	Moderate	Noise monitoring will be conducted regularly to assure compliance	Contractor	Noise Monitoring around the construction boundaries during daytime and nighttime	Monthly	Part of best working practice
NOISE - Operation Phase						
Noise Control	Moderate to High	Noise mitigation measures will be incorporated into the design of the turbines, including: - The turbines with reduced noise operation system will be chosen in order to minimize noise emissions - The turbines are properly positioned in terms of possible noise emissions.	Contractor	Noise monitoring around the nearest sensitive receptor in Çakmaklı Village	Monthly during the first year and then yearly afterwards.	Inherit in Design

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
		The turbines are equipped with optional noise reduced power operation modes to accommodate noise restrictions				
VISUAL IMPACT – Construction Phase						
Waste Management	Moderate	All debris and wastes will be collected, stored, and transported in an orderly manner to prevent any adverse visual impact on the surrounding area.	Contractor	Visual inspection	Daily	Part of best working practice
Visual Management	Moderate	Construction camp site will be compact, kept clean and well maintained. Building material at the camp will be well maintained and newly painted to match with the local environment.	Contractor	Visual inspection	Daily	Part of best working practice
	Moderate	Project equipment storage area will be maintained properly to prevent adverse visual impact.	Contractor	Visual inspection	Daily	Part of best working practice
	Moderate	Construction camp site and equipment lay down area will be reinstated to original after the construction.	Contractor	Visual inspection	Daily	Part of best working practice
VISUAL IMPACT – Operation Phase						
Visual Management	Moderate to High	The turbines will be maintained in uniform size (e.g. direction of rotation, type of turbine and tower, and height).	Contractor	-	-	Inherit in Design
	Moderate to High	The edges of the turbine blades will be painted by a reflecting color and lightening system will be installed in order to provide aviation safety.	Contractor	-	-	Inherit in Design
	Moderate to High	Proper landscaping will be provided around the control and operations area.	Contractor	-	-	Inherit in Design

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Moderate to High	Lettering, company insignia, advertising, or graphics on the turbines will be avoided.	Operator	-	-	Part of best working practice
	Moderate to High	Turbines will be painted a uniform color, typically matching the sky (light gray or pale blue).	Contractor	-	-	Inherit in Design
AIR QUALITY - Construction Phase						
Dust	Moderate	Where possible, the contractor will select equipment designed to minimize dust emissions	Contractor	Visual inspections	Daily	Part of best working practice
	Moderate to high	Activities that produce significant dust emissions will be monitored during periods of high winds and dust control measures implemented as appropriate.	Contractor	Visual inspections	Daily and when high winds	Part of best working practice
	Moderate	Stockpiles of soil and similar materials will be carefully managed to minimize the risk of windblown dust, e.g. water spray dampening soils and spoil and during delivery and dumping of sand and gravel during periods of dry weather.	Contractor	Visual inspections	Daily	Part of best working practice
	Moderate	Loading and unloading of material that could generate dust will be done without throwing into the air.	Contractor	Visual inspections	Daily	Part of best working practice
Dust	Moderate	Where possible, drop heights for material transfer activities, e.g. unloading of friable materials, will be minimized and carefully managed.	Contractor	Visual inspections	Daily	Part of best working practice
	Moderate	On-site and access roads will be well maintained through mechanical means (sweeping or vacuuming) or spraying with water.	Contractor	Visual inspections	Daily	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Moderate	Vehicle speeds on un-surfaced roads will be limited to 30 km/h;	Contractor	Visual inspections	Daily	Part of best working practice
	Moderate	Lorries used for the transportation of friable construction materials and spoil off-site will be covered/sheeted.	Contractor	Visual inspections	Daily	Part of best working practice
Gaseous Pollutants	Moderate	Best control technology will be adopted to reduce emissions from fuel storage, combustion emissions from engines and any other temporary equipment.	Contractor	-	-	Part of best working practice
	Low to moderate	Engines will not be left running unnecessarily. Engines will be switched off when not in use.	Contractor	Visual inspections	Daily	Part of best working practice
	Low to moderate	Regular maintenance of vehicles will be undertaken to ensure that vehicles are safe and that emissions are minimized.	Contractor	Visual inspections	Daily	Part of best working practice
	Moderate	All vehicles will be maintained so that their exhaust emissions do not cause nuisance to workers or local people.	Contractor	Visual inspections	Daily	Part of best working practice
HAZARDOUS WASTE - Construction Phase						
Hazardous Waste Management	Moderate to High	Hazardous wastes will be segregated from non-hazardous wastes and its management will focus on the prevention of harm to health, safety, and the environment.	Contractor	Visual inspections	Continuously	Part of best working practice
	Moderate to High	Hazardous wastes will be stored in containers that are non-damaged, leak-proof, safe and appropriate for the international standards, on concrete place within the land of the facility.	Contractor	Visual inspections	Continuously	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Moderate to High	The hazardous waste containers will be checked routinely in order to determine whether they are damaged	Contractor	Visual inspections	Continuously	Part of best working practice
	Moderate to High	Hazardous waste containers will be kept closed and wastes will be stored in a way that they will not go in chemical reactions.	Contractor	Visual inspections	Continuously	Part of best working practice
Hazardous Waste Management	Moderate to High	The hazardous liquid wastes will be collected in metal or plastic drums and stored in an area with a concrete surface and a proper secondary containment to prevent potential spills and leakages reaching to soil or groundwater.	Contractor	Visual inspections	Continuously	Part of best working practice
	Moderate to High	Transportation of the wastes will be done by the persons and entities that are licensed for this work and by the vehicles appropriate for the properties of the transported waste. The hazardous wastes will be sent to a licensed disposal facility.	Contractor	Visual inspections	When required	Part of best working practice
	Low to Moderate	Waste battery and accumulators will be collected separately from household wastes and will be delivered to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities within six months after they are generated.	Contractor	Visual inspections	Continuously	Part of best working practice
HAZARDOUS WASTE - Operation Phase						
Hazardous Waste Management	Moderate to High	Waste oils will be stored red colored tanks/ containers with a label of "Waste Oil" on it and these containers will be placed at the areas with secondary containment. These wastes will be removed to a licensed disposal facility by licensed transporters.	Operator	Visual inspections	When required	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Low to Moderate	Waste battery and accumulators will be collected separately from household wastes and will be delivered to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities within six months after they are generated.	Operator	Visual inspections	Continuously	Part of best working practice
	Low to Moderate	"Hazardous waste" label will be placed on to the containers and this label will indicate the amount of stored waste as well as the storage time of the hazardous waste. Hazardous solid wastes generated during construction will be collected and stored in a concrete area with proper labeling.	Operator	Visual inspections	Continuously	Part of best working practice
	Low to Moderate	Any hazardous waste will be collected in leak-proof containers and removed to a licensed disposal facility by licensed transporters. The hazardous wastes will be handled, stored, transported and disposed of according to the Turkish Hazardous Wastes Control Regulation, Waste Oils Control Regulation and Waste Batteries and Accumulators Control Regulation, and the IFC guidelines.	Operator	Visual inspection	Continuously	Part of best working practice
NON-HAZARDOUS WASTE - CONSTRUCTION & OPERATION						
Non-Hazardous Waste Management	Low to Moderate	The wastes will be characterized according to composition, source, types of wastes produced, generation rates, or according to local regulatory requirements.	Operator	Visual inspections	Continuously	Part of best working practice
	Low to Moderate	Feasible waste prevention, reduction, reuse, recovery and recycling measures will be taken, waste materials will be treated and disposed of and all measures will be taken to avoid potential impacts to human health and the environment.	Operator	Visual inspections	Continuously	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Low to Moderate	Solid wastes that could be recycled, like cement bags, metal scraps, packing boxes and wooden crates, etc. will be separated and stored temporarily on site for eventual recycling process.	Contractor	Visual inspections	Weekly	Part of best working practice
	Low to Moderate	Solid wastes that are non-recyclable and non-hazardous will be collected and properly disposed in a waste disposal site by local Municipality.	Operator	Visual inspections	Continuously	Part of best working practice
	Low to Moderate	The paper, plastic and glass content in the wastes will be separated for recycling.	Operator	Visual inspections	Continuously	Part of best working practice
Non-Hazardous Waste Management	Low to Moderate	The non-recyclable solid wastes will be sorted and accumulated inside appropriate, leak proof, non-contaminating drums for eventual disposal at the site designated by the local Municipality.	Operator	Visual inspections	Weekly	Part of best working practice
	Low to Moderate	The domestic waste will be collected in special trash bins onsite and made available for the local municipality collection trucks.	Operator	Visual inspections	Daily	Part of best working practice
	Low to Moderate	The excavation, construction and demolition wastes will be reused where possible. In case they can not be used they will be disposed to the places approved by the Municipality or relevant authorities according to the Excavation, Construction and Demolition Waste Control Regulation.	Contractor	Visual inspections	When required	Part of best working practice
BIOLOGICAL RESOURCES AND HABITAT ALTERATION - Construction Phase						
Flora	Moderate to High	Topsoil will be removed and stored on site for future landscaping purposes.	Contractor	Visual inspections	When required	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
Fauna	Moderate to High	Hunting of animals and collecting ground nests for resident birds will be prohibited.	Contractor	Visual inspections	Daily	Part of best working practice
	Moderate to High	All solid and liquid wastes during construction will be collected and disposed in the nearest disposal sites to decrease the impact on fauna	Contractor	Visual inspections	Daily	Part of best working practice
	Moderate to High	Turbines will be made in a tubular structure, which will deter birds from landing or perching on them.	Contractor	-	-	Part of best working practice
BIOLOGICAL RESOURCES AND HABITAT ALTERATION - Operation Phase						
Flora	Moderate	Off road driving will be avoided.	Operator	Visual inspections	When required	Part of best working practice
Fauna	Moderate to High	Hunting will be prohibited at and around Project site by the personnel	Operator	Visual inspections	When required	Part of best working practice
	Moderate to High	The top of blades will be painted with noticeable colors.	Operator	-	-	-
	High	Since the Project site is located at the border of Important Bird Area, a monitoring study will be carried out in the first year of operation.	Operator	Visual inspections	Monitoring in the first year during migration periods	Part of best working practice
	Moderate to High	Appropriate storm water management measures will be implemented to avoid creating small ponds which can attract birds and bats for feeding or nesting near the wind farm.	Operator	Visual inspections	Continuously	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Moderate to High	Low intense and blinking lights will be preferred obstruction lights in order to minimize the risk of avian collision.	Operator	-	-	Part of best working practice
CULTURAL HERITAGE - Construction Phase						
Cultural and Archeological Resources	High	Construction works will be monitored for archaeological remains.	Contractor	Visual inspections	Daily	Part of best working practice
	High	If any archeological remains are discovered, as the national law requires, the Project will cease excavation at this location and the local Department of Culture and Tourism will be informed immediately.	Contractor	Visual inspections	Daily	Part of best working practice
TRAFFIC - Construction Phase						
Traffic Management	Moderate to high	Safety and traffic signs will be clearly placed near and around the Project site on the road to the Project site.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Scheduling of traffic will be undertaken to avoid the peak hours on the local road network wherever practicable.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate to high	Special loads will adhere to prescribed routes to be agreed with the appropriate authorities - these will be scheduled to avoid peak hours on local roads and published well in advance to minimize possible disruption	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Road safety training and adherence to speed limits will be stressed to all drivers.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Prescribed routes for construction traffic will be agreed	Contractor	Visual inspections	During the activity	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
		with the appropriate authorities, particularly with respect to tanker and truck traffic and special loads.			activity	working practice
	Moderate	Entrance to the site will be clear and properly designed.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	To protect the roads, trucks which will be used for transporting activities should have a gross weight within the axial permissible load	Contractor	Visual inspections	During the activity	Part of best working practice
TRAFFIC - Operation Phase						
Traffic Management	Moderate	Road safety training and adherence to speed limits will be stressed to all drivers	Operator	Visual inspections	Continuously	Part of best working practice
	Moderate	Safety and traffic signs will be clearly placed near and around the Project site on the way to Project site.	Operator	Visual inspections	Continuously	Part of best working practice
	Moderate	To protect the roads, trucks which will be used for transporting activities should have a gross weight within the axial permissible load	Operator	Visual inspections	Continuously	Part of best working practice

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ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
ON SITE HEALTH AND SAFETY – Construction and Operation Phases						
Working at Height	High	The safety harness will be used to secure persons during ascent to and descent from the nacelle of the wind turbine generator system and when carrying out work in areas where there is a falling hazard. Together with the safety harness, the traveling safety hook constitutes a safety device for ascent/descent via the ladder inside the tower. All the precautions related with working at heights will be taken throughout the construction and operational phases of the proposed Project in accordance with the IFC Guidelines and the local regulations.	Contractor, Operator	Inspection to ensure the effectiveness of the mitigation measure	Continuously	Part of best working practice
Emergency Exit	High	The wind turbine generator system is provided with an emergency exit system consisting of an emergency descending device. The emergency exit consists of a hatch located at the back of the nacelle.	Contractor	Inspection to ensure the effectiveness of the mitigation measure	-	Inherit in design
Noise	High	Heavy machinery that used in the construction activities will be provided with good rubber insulation for windows and doors to protect the drivers.	Contractor	Inspection to ensure the effectiveness of the mitigation measure	Daily	Part of best working practice
	High	Ear protection equipment will be used in all areas of a potential source of high noise.	Contractor	Inspection to ensure the effectiveness of the mitigation measured	Daily	Part of best working practice

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ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
Hazardous Chemicals and Waste	High	Material Safety Data Sheets for all chemicals used at the plant will be available at site and in easy reach to concerned employees. Employees will be trained on the proper handling of chemicals and be informed of their hazards. Such material data sheet will be included within a safety manual for this operation. Proper and approved Personal Protective Equipment (PPE) will be provided to all employees handling chemicals and will be trained on their use and maintenance.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
Accidents	High	A first aid box will be located in the nacelle of the wind turbine system for the treatment of minor injuries.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
	High	A Safety Manual will be prepared for the construction and operation activities.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
Fire Hazards	High	Two fire extinguishers will be available in the wind turbine generator system. One fire extinguisher will be mounted on the down tower assembly in the tower base, the other one on the top box in the nacelle. Employees will be trained on the use of fire fighting systems and equipment.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
Fire Hazards	High	The wind turbine will be equipped with lightning protection systems which have the task of diverting the lightning currents arising from lightning strikes and the energy associated with the lightning into the ground in a controlled manner. The turbine will be equipped with receptors, e.g. on the blades, that receive the lightning current and divert it through predefined paths within the	Contractor	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Inherit in design

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
		turbine to the ground.				
HS Monitoring Program	High	A comprehensive occupational health and safety monitoring program will be prepared prior to start of the Project.	Operator	Inspection to ensure the effectiveness of the mitigation measure	-	Part of best working practice
PUBLIC HEALTH AND SAFETY - Construction and Operation Phases						
Public Health and Safety	Moderate to High	The wind farm will be located within a security fence ensuring to prevent pass or accidental entry of the site by local people. The switchyard will be fenced in the scope of the Project to prevent public access. Access to turbine towers will be prevented.	Contractor, Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Inherit in design
	Moderate to High	Information boards about public safety hazards and emergency contact information will be available in the wind farm.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
	Moderate to High	The transport of equipments, turbines and materials will be undertaken in an appropriate manner.	Contractor, Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
	Moderate to High	Project vehicles and equipment will be well maintained and Project related traffic will be requested to travel no faster than the speed limit.	Contractor, Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice

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ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
SOCIAL IMPACT- Construction and Operation Phases						
Employment opportunities	Moderate	A recruitment approach will be developed to hire workers from region and especially from project-affected communities during construction phase.	Project owner	Inspection to ensure the effectiveness of the mitigation measure	-	Part of best working practice
Community Relations	Moderate to High	The followings will be carried out for manage and mitigate the tension/dispute between local resident and workers ▪ The local people will be informed regularly on the progress of the project and works, ▪ Any dispute will be managed between the Contractors and local residents ▪ An alcohol and drug policy will be developed, ▪ Construction personnel will be prohibited from illegal activities, ▪ Non-authorized personnel will not be allowed into the camps, ▪ Personnel will be trained for the cultural awareness, ▪ Community's right to privacy will be respected.	Project owner	Inspection to ensure the effectiveness of the mitigation measure	During Construction	Part of best working practice

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10.0 PUBLIC CONSULTATION AND DISCLOSURE

10.1 Consultation Process

In the scope of the Karadağ Wind Power Plant ESA study, a public consultation and participation meeting was held in Çakmaklı Village in order to inform the public about the Project. The aim of these meeting was to involve stakeholders in a discussion which focuses on the local social and environmental impacts. The meeting was organized by GAIA Finansal Danışmanlık Hizmetleri Tic. Ltd. Şti. and AECOM on behalf of GARET.

About a month before the meeting, the headman (muhtar) of the village was called and informed about the meeting. Some brief information about the project was also given to the muhtar during this call. In addition, AECOM visited the site during the ESA baseline study and talked with the local people about the project before the preparation of the ESA Report. All residents of the village were invited to the meeting. In addition to general public, national regulatory authorities, local regulatory authorities, local agencies, non-governmental organizations, were also invited to this meeting. The following stakeholders were contacted: REC, TEMA, WWF, Greenpeace, Helio International, and Mercy Corps. Relevant stakeholders were contacted by GAIA via various communication ways such as sending letters to the invitees, announcements on local and national newspapers, and posting announcements.

The meeting in Çakmaklı Village was held at the village coffeehouse on August 09, 2010. There were 37 participants present in the meeting as it is seen in the pictures taken during the meeting (See Figure 10-1). This was a good turn around considering the size of the village.

In this meeting, a brief project description was given and environmental issues regarding the project were presented by AECOM and a presentation was made by GAIA, a Carbon Asset Development Consultancy Company, in the scope of the Gold Standard Scheme. The second presentation from the carbon asset developing company focused on climate change and the climate change benefits of the project.

The presentations were followed by a Questions & Answers (Q&A) session. Questions raised by the public participated the meeting were responded. A few questions were asked by the public during the meeting. Most of the questions were related to construction schedule and project size. The residents of the village were concerned that the hill, where the wind farm will be located, could be allocated for further development for other heavy and polluting industrial activities in the region. Thus, all participants without any exception encouraged the project owner to start the construction of the wind farm immediately. The participants were highly educated and knowledgeable with wind farm projects and operations. They clearly indicated that the environmental impacts of wind farms are negligible compared to the other industrial activities operating in the area and thus they were fully supporting the proposed project. They were even encouraging the project owner to build more turbines on the hill and on the shore if it is feasible. They have stated that if the proposed wind farm is constructed on the

hill, the hill would not be damaged by potential industrial activities and would be saved as the forest land.

10.1.1 Consultation during Scoping

In the scoping period of the project, public hearing meetings were held in Çakmaklı Village as discussed in the previous section. The project is described and questions of participants were answered in these meetings.

10.1.2 Consultation during Construction

The GARET will provide consultation during construction period together with the contractors. The implementation of mitigation measures will be monitored during construction. The contractor will be monitored and audited by the GARET and a third party independent auditor in terms of environmental and social compliance. The community will be warned prior to any activity that they should be aware of. Community related issues that may impact on construction will be identified by the contractor and evaluated by the operator. The complaints against the project during the construction period will be managed through grievance mechanism. The incidents and accidents will be reported during the construction period.

The local people in the project area refer to Muhtar in terms of information sharing and monitoring for the project. In the village life, the Muhtar plays an important role as a trustee and as someone who shares official information with the people. Therefore, for advice on sharing for project information and monitoring, local people refer to Muhtar with comfort. Therefore, GARET and contractors will cooperate with the Muhtar and explain the monitoring process and indicators for future reference.

10.1.3 Consultation during Operation

GARET, as the project owner, will provide consultation during operation period together with the contractors. The communities in the vicinity of the wind farm will be made aware of the safety issues. The compliance of the landowners with the land use constraints will be maintained. The implementation of mitigation measures will be monitored. The complaints of the local people will be managed through grievance mechanism. The incidents and accidents will be reported during the operation period.

10.2 Grievance Mechanism

In the scope of the proposed Project, a grievance mechanism will be implemented in order to ensure that complaints of the people affected by the Project are considered and resolved with corrective actions by GARET. In the scope of the grievance mechanism, complaints and requests received by GARET will be forwarded to the Corporate Communication Department. People could send their complaints or requests to GARET by phoning the project office or informing Public Relations officer about their concerns. In addition, the Compliant/Request Form and Complaint/Request Close-out Form which are used for receiving and closing-out of the complaint/request are prepared in the scope

of the grievance mechanism. These forms are presented below. Corporate Communication Department will take necessary actions for the consideration of complaint or request. Feed back will be given to the person and institutions that have complaint or request in fifteen days at latest.





Figure 10-1 Public Participation Meeting in Çakmaklı Village

COMPLIANT/REQUEST FORM

Compliant/Request Form Register No		
Recorded by		
Province/District/Residential Area		
Date		
Information on Complaint/Request		
<i>Description of the Complaint/Request:</i>		
Information on Person/s who have a Complaint/Request		The Way of Declaration
Name-Surname		☐ By telephone ☐ By Public Meetings ☐ Communication Desk ☐ Visit ☐ Internet ☐ Other
Phone Number		
Address		
Village/Residential Area		
District/Province		
Signature of Person/s who have a Complaint/Request <i>Signature will be requested only for the complaint/request received by meeting, communication desk and visit.</i>		

COMPLAINT/REQUEST CLOSE-OUT FORM

Compliant/Request Form Register No (Register number should be same as the number of <i>compliant/request form</i>)			
Recorded by			
Date			
Please Explain the Short-term Necessary Action?			
Please Explain the Long-term Necessary Action? (if necessary):			
Is compensation requested?			
CONFIRMATION and CLOSE-OUT of CORRECTIVE ACTION			
Corrective Action Steps		Date of Close-out	Responsible Person / Department
1			
2			
3			
4			
5			
6			
7			
COMPLIANT/REQUEST CLOSE-OUT			
This section will be filled out and signed by the person who has a Complaint/Request and GARET when compensation is received and/or folder is closed-out (The complaints received by internet could be responded via mail without signature). Notes: Date: / /			
Person who have a Complaint/Request Name-Surname and Signature		On behalf of GARET Title-Name-Surname and Signature	

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Appendix A

SITE PHOTOLOG

KARADAĞ WIND FARM PROJECT

PHOTOGRAPHIC LOG

Client Name: GAMA/GE

Site Location: Aliağa, İzmir Turkey

Project No. 266.01.01

Photo No.
1

Date:
11/11/2009

Direction Photo Taken:
Northeast

Description: T1 Location

Turbine 1 (T1) will be located in northern part of the project site. The location of the turbine is the northern side of the hill located in the project site.



Photo No. 2	Date: 11/11/2009	CONFIDENTIAL 
Direction Photo Taken: NorthEast		
Description: T2 Location Turbine 2 (T2) will be located in western part of the project site. It is the closest turbine to the summer houses situated in the west of the project site.		

gmelin@iic.org

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Photo No. 3	Date: 11/11/2009	
Direction Photo Taken: East		
Description: T3 Location Turbine 3 (T3) is situated in the eastern part of the project site.		

Photo No.
4

Date:
11/11/2009

Direction Photo Taken:
South

Description: T4 Location

Turbine 4 (T4) is located in the southern of the project site. It is the closest turbine to the Çakmaklı Village situated in the southwest of the project site.



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Photo No.
5

Date:
11/11/2009

Direction Photo Taken:
North

Description: MAST 30m

One of the MAST towers located in the project site is 30 m Mast 1 tower. It is located in the northern part of the project site.



Photo No. 6	Date: 11/11/2009	
Direction Photo Taken: East		
Description: MAST 50m The second MAST tower in the project site has a height of 50m. It is located at the hill top in the middle of the project site.		

Photo No. 7	Date: 11/11/2009	
Direction Photo Taken: East		
Description: Aliaga Town The view of Aliaga Town from the project location.		

Photo No.
8

Date:
11/11/2009

Direction Photo Taken:
North

Description: Switchyard

The switchyard will be located near the Turbine 1 (T1) location in the northern part of the project site.



Appendix B

SHADOW MODELING RESULTS

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APPENDIX B

Shadow Modeling Results

Main Result Report

WindPRO version 2.6.1.252 Jan 2009

Project:

Karadag Wind Farm Project

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AECOM TURKEY

Calculated:

12/3/2009 3:11 PM/2.6.1.252



SHADOW - Main Result

Calculation: Shadow Modeling

Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.06	0.06	0.11	0.10	0.25	0.50	0.69	0.70	0.60	0.20	0.10	0.07

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
144	587	1,561	632	90	145	421	574	489	242	145	200

W	WNW	NW	NNW	Sum
253	245	168	92	5,990

To avoid flicker from WTGs not visible a ZVI calculation is performed before the flicker calculation. The ZVI calculation is based on the following assumptions

Height contours used: 10m Contour

Obstacles used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



* Existing WTG

Scale 1:25,000
Shadow receptor

WTGs

UTM ED50 Zone: 35				WTG type		Type-generator Power,			Shadow data		
East	North	Z	Row	Valid	Manufact.	rated	Rotor	Hub	Calculation	RPM	
UTM ED50 Zone: 35				data/Description		[kW]	diameter	height	distance	[m]	[RPM]
		[m]					[m]	[m]			
T1	492,555.92	4,290,323.02	86.9	T1	Yes	GE WIND ENERGY GE 2.5xl-2,500	2,500	100.0	85.0	1,575	14.0
T2	492,529.43	4,289,946.16	115.7	T2	Yes	GE WIND ENERGY GE 2.5xl-2,500	2,500	100.0	85.0	1,575	14.0
T3	492,838.05	4,289,940.97	107.2	T3	Yes	GE WIND ENERGY GE 2.5xl-2,500	2,500	100.0	85.0	1,575	14.0
T4	492,881.66	4,289,588.74	86.7	T4	Yes	GE WIND ENERGY GE 2.5xl-2,500	2,500	100.0	85.0	1,575	14.0

Shadow receptor-Input

		UTM ED50 Zone: 35		Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
No.	Name	East	North							
				[m]	[m]	[m]	[m]	[°]	[°]	
Shadow Receptor 1	Shadow Receptor 1	492,195.83	4,289,592.57	22.8	1.0	1.0	1.0	-180.0	90.0	"Green house mode"
Shadow Receptor 2	Shadow Receptor 2	492,245.32	4,289,395.20	16.0	1.0	1.0	1.0	-180.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, worst case			Shadow, expected values	
No.	Name	Shadow hours per year	Shadow days per year	Max shadow hours per day	Shadow hours per year	
		[h/year]	[days/year]	[h/day]	[h/year]	
Shadow Receptor 1	Shadow Receptor 1	19:07	44	0:33	2:48	
Shadow Receptor 2	Shadow Receptor 2	46:26	89	0:36	10:22	

WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tlf. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

WindPRO version 2.6.1.252 Jan 2009

Project:

Karadag Wind Farm Project

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**SHADOW - Main Result****Calculation:** Shadow Modeling

Total amount of flickering on the shadow receptors caused by each WTG

No. Name Worst case

No.	Name	Worst case
		[h/year]
T1	T1	0:00
T2	T2	0:00
T3	T3	0:00
T4	T4	65:33

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Shadow Calendar Graphs

WindPRO version 2.6.1.252 Jan 2009

Project:

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Calculated:

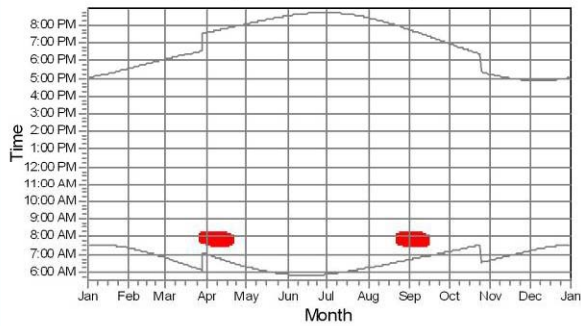
12/3/2009 3:11 PM/2.6.1.252



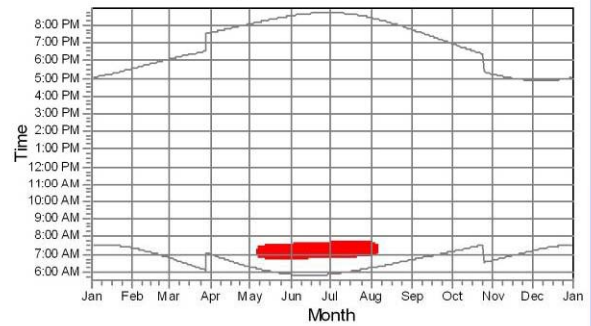
SHADOW - Calendar, graphical

Calculation: Shadow Modeling

Shadow Receptor 1: Shadow Receptor 1



Shadow Receptor 2: Shadow Receptor 2



WTGs

 T4: T4

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Shadow Contour Map

WindPRO version 2.6.1.252 Jan 2009



Map: Karadag Wind Farm Satellite Image , Print scale 1:20,000, Map center UTM ED50 Zone: 35 East: 492,660.00 North: 4,290,021.82
 * Existing WTG * Shadow receptor
 Isolines showing shadow in Shadow hours per year. Real value calculation.
 2 5 10 20 30 50

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Project:

Karadag Wind Farm Project

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SHADOW -

Karadag Wind Farm Satellite Image

Calculation:

Shadow Modeling

File:

Karadag_RES_Sat_Img.bmi

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