Republic of Azerbaijan
Azerenerji JSC

Republic of Azerbaijan

Preparatory Survey on Yashma Gas Combined Cycle Power Plant Project

Final Report

August, 2014

Japan International Cooperation Agency (JICA)

Tokyo Electric Power Services Co., LTD

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Abbreviations

Abbreviations	Words
ADB	Asian Development Bank
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
C/P	Counterpart
CCPP	Combined Cycle Power Plant
Df/R	Draft Final Report
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ES	Engineering Stage
EPC	Engineering, Procurement and Construction Contract
FIRR	Financial Internal Rate of Return
F/R	Final Report
F/S	Feasibility Study
GT	Gas Turbine
GTW	Gas Turbine World
HHV	Higher Heating Value
HP	High Pressure
HRSG	Heat Recovery Steam Generator
I&C	Instrumentation and Control
Ic/R	Inception Report
IP	Intermediate Pressure
IFC	International Finance Corporation
IPP	Independent Power Producer
ISO	International Standard Organization
JICA	Japan International Cooperation Agency
JSCA	Azerenerji Joint Stock Company
LHV	Lower Heating Value
LP	Low Pressure
MW	Mega Watt
NOx	Nitrogen Oxide
NG	Natural Gas
NGO	Non-Governmental Organization
NHC	National Holding Company
O&M	Operation and Maintenance
ODA	Official Development Assistance
OEM	Original Equipment Manufacturer
Sox	Sulfur Oxide
ST	Steam Turbine
TOR	Terms of Reference
TPP	Thermal Power Plant
USD	United States Dollar
VAT	Value Added Tax
W/S	Work Shop
WB	World Bank

Units

Prefixes		
μ	:	micro- $= 10^{-6}$
m	:	milli- $= 10^{-3}$
c	:	centi- $= 10^{-2}$
d	:	deci- $= 10^{-1}$
da	:	deca- $= 10$
h	:	hecto- $= 10^{2}$
k	:	kilo- $= 10^{3}$
M	:	mega- $= 10^{6}$
G	:	giga- $= 10^{9}$
Units of Length		
m	:	meter
mm	:	millimeter
cm	:	centimeter
km	:	kilometer
in	:	inch
ft	:	feet
yd	:	yard
Units of Area		
cm^2	:	square centimeter
m^2	:	square meter
km^2	:	square kilometer
ft^2	:	square feet (foot)
yd^2	:	square yard
ha	:	hectare
Units of Volume		
m^3	:	cubic meter
l	:	liter
kl	:	kiloliter
Units of Mass		
g	:	gram
kg	:	kilogram
t	:	ton (metric)
lb	:	pound
Units of Density		
kg/m^3	:	kilogram per cubic meter
t/m^3	:	ton per cubic meter
mg/m^3N	:	milligram per normal cubic meter
g/m^3N	:	gram per normal cubic meter
ppm	:	parts per million
μg/scm	:	microgram per standard cubic meter
Units of Pressure		
kg/cm^2	:	kilogram per square centimeter (gauge)
lb/in^2	:	pound per square inch
mmHg	:	millimeter of mercury
mmHg abs	:	millimeter of mercury absolute
mAq	:	meter of aqueous
lb/in^2, psi	:	pounds per square inches

atm	:	atmosphere
Pa	:	Pascal
bara	:	bar absolute
Units of Energy		
kcal	:	kilocalorie
Mcal	:	megacalorie
MJ	:	mega joule
TJ	:	tera joule
kWh	:	kilowatt-hour
MWh	:	megawatt-hour
GWh	:	gigawatt-hour
Btu	:	British thermal unit
Units of Heating Value		
kcal/kg	:	kilocalorie per kilogram
kJ/kg	:	kilojoule per kilogram
Btu/lb	:	British thermal unit per pound
Units of Heat Flux		
$kcal/m^2h$	:	kilocalorie per square meter hour
Btu/ft^2H	:	British thermal unit per square feet hour
Units of Temperature		
deg	:	degree
°	:	degree
C	:	Celsius or Centigrade
°C	:	degree Celsius or Centigrade
F	:	Fahrenheit
°F	:	degree Fahrenheit
Units of Electricity		
W	:	watt
kW	:	kilowatt
A	:	ampere
kA	:	kiloampere
V	:	volt
kV	:	kilovolt
kVA	:	kilovolt ampere
MVA	:	megavolt ampere
Mvar	:	megavar (mega volt-ampere-reactive)
kHz	:	kilohertz
Units of Time		
s	:	second
min	:	minute
h	:	hour
d	:	day
y	:	year
Units of Flow Rate		
t/h	:	ton per hour
t/d	:	ton per day
t/y	:	ton per year
m^3/s	:	cubic meter per second
m^3/min	:	cubic meter per minute
m^3/h	:	cubic meter per hour
m^3/d	:	cubic meter per day

lb/h	:	pound per hour
m^3N/s	:	cubic meter per second at normal condition
m^3N/h	:	cubic meter per hour at normal condition

Units of Conductivity

μS/cm	:	microSiemens per centimeter

Units of Sound Power Level

dB	:	deci-bell

Units of Currency

US$	:	US Dollar
¥	:	Japanese Yen

Executive Summary

(A part of this summary has been removed because of confidential information.)

Executive Summary

1. Background of Survey

In the “State program for development of fuel and energy sector in Azerbaijan (2005-2015)” and “Look into the future development concept 2020” of the Republic of Azerbaijan (hereinafter referred to as “Azerbaijan”), major themes are the development of electric power sources and maintenance of associated equipment to ensure a stable electric power supply. In response Azerenerji Joint Stock Company (JSCA) issue a development plan for an electric power plant that utilizes natural gas as essential fuel.

Azerbaijan’s installed power capacity is 6,860 MW, with thermal power plants including gas-engine plants accounting for 5,881 MW and hydro power plants 979MW in 2014. However, effective generation capacity remains around 5,000MW due to the aging and deterioration of major power plants. Since maximum demand of electric power in 2013 was 3,720 MW, current power supply capacity is sufficient to meet Azerbaijan’s power demand. That said, Azerenerji forecasts that power demand will grow at an annual rate of around 5% as a result of stable economic growth, with demand peaking at around 5,450MW in 2020. In order to cope with increasing power demand and realize the phased decommissioning plan of the Azerbaijan Power Station (2,400MW), which is a conventional dual fuel (gas and oil) fired power station constructed more than 30 years ago, the country needs to develop additional electric capacity of around 1,800MW between 2018 and 2020. Moreover, the Azerbaijan Power Station, which comprises a major share of power generation and is located about 250km west of the capital Baku, supplies power to Baku through long-distance transmission lines: power systems utilizing long-distance transmission lines are prone to transmission loss as well as blackouts.

Based on this recognition, development of additional capacity near the capital Baku area, improvement of power transmission lines and substations, and support for proper utilization of facilities are now viewed as legitimate and imperative goals to ensure a highly stable power supply.

2. Purpose of Survey

The purpose of the survey is to carry out studies necessary for judging whether the project is viable as an ODA yen loan project in accordance with the minutes of meetings agreed upon between Azerenerji Joint Stock Company (JSCA) and Japan International Cooperation Agency (JICA) on June 2013. The studies include assessment of project rationale, preparation of conceptual design, construction cost, implementation schedule, implementation (procurement and construction) methods, implementation structure, management and operation and maintenance systems, and assessment of environmental and social considerations of the project.

3. Project Overview

Table 3-1 shows the Project Overview for Yashma Gas Combined Cycle Power Plant (Yashma CCPP). The location of the Yashma Project Site is shown in an aerial photograph map in Figure 3-1.

Table 3-1 Project Overview

Items	Contents
Owner	Azerenerji Joint Stock Company (JSCA)
Name	Yashma Combined Cycle Power Plant
Site	Sumgayit city in Azerbaijan (45km northwest of Baku)
Area	71.5 ha
Type	Combined Cycle Power Plant
Capacity	Two single shafts, total capacity 900 to 950 MW
Fuel	Natural Gas
Expected Taking Over #1 #2	 2020 2021

Source: Google earth

Figure 3-1 Location of Yashma Project Site

4. Implementation Schedule

This part has been removed because of confidential information.

Figure 4-1 Expected Project Implementation Schedule for Yashma CCPP Project

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5. Conclusions

The Yashma CCPP construction project has been determined to be feasible in both the technological and economic aspects, as a result of this Preparatory Survey. The Yashma CCPP Project is a new construction plan for two single shafts, total capacity 900 to 950 MW of natural gas fired combined cycle power plant.

The planned site of the power plant is the property of the Azerbaijan government. Environment Impact Assessment (EIA) for the Yashma CCPP project has already been completed, and the EIA approval process is under way in Azerbaijan. When consideration is given to a power plant that meets growing electricity demand and operates as a base power source replacing the existing aged power plants, the Yashma CCPP Construction Project which has satisfied all construction site requirements should be regarded as top priority. Through introduction of a high-efficiency power generation technology, reduced emission of nitrogen oxide is expected. This technology can also reduce the consumption of Natural Gas as a fuel for power generation by a greater percentage. There is a sufficient reason to support this project when consideration is given to the future power supply-demand balance and necessity of efficient use of Natural Gas within the country.

6. Recommendation

To implement the Yashma CCPP Construction Project, Azerenerji JSC - as the Azerbaijan counterpart - is required to take the following actions:

The key point is in financing. This project - including Transmission Line & Substation and Fuel Gas pipeline development should be defined as a national project, and a detailed overall strategic plan should be worked out. In case of funding gap, actions should then be taken to work on the international financial institutions on a nationwide basis. Moreover, it is necessary to select the proper strategic partner carefully and to advance in a direction beneficial for the Republic of Azerbaijan.

The repayment schedule is equally important to the fund procurement. It is desirable that electricity tariff surely cover the construction cost, operation and maintenance cost. For this purpose, it is necessary to reconsider the electricity tariff system in order to establish the repayment schedule.

Chapter 1

Preface

Chapter 1 Preface

1.1 Background of Survey

In the “State program for development of fuel and energy sector in Azerbaijan (2005-2015)” and “Look into the future development concept 2020” of the Republic of Azerbaijan (hereinafter referred to as “Azerbaijan”), major themes are the development of electric power sources and maintenance of associated equipment to ensure a stable electric power supply. In response Azerenerji Joint Stock Company (JSCA) issue a development plan for an electric power plant that utilizes natural gas as essential fuel.

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Based on this recognition, development of additional capacity near the capital Baku area, improvement of power transmission lines and substations, and support for proper utilization of facilities are now viewed as legitimate and imperative goals to ensure a highly stable power supply.

1.2 Purpose of Survey and Scope of Survey

1.2.1 Purpose of Survey

The purpose of the survey is to carry out studies necessary for judging whether the project is viable as an ODA yen loan project in accordance with the minutes of meetings agreed upon between Azerenerji Joint Stock Company (JSCA) and Japan International Cooperation Agency (JICA) on June 2013. The studies include assessment of project rationale, preparation of conceptual design, construction cost, implementation schedule, implementation (procurement and construction) methods, implementation structure, management and operation and maintenance systems, and assessment of environmental and social considerations of the project.

1.2.2 Scope of Survey

The scope of this survey is as follows:

(1) Terms of reference

1) Review of the current situation of the power sector
   a) Review of demand forecast
   b) Progress of on-going, planned power plant projects
   c) Power system planning

d) Review of State Development Plan, Energy and Electric Power Sector Development Policy
e) Analysis on technical/commercial loss, record of power failure incidents, power supply stability
f) Record of power exchange/trade, status of grid connection with neighboring countries

2) Confirmation/recommendation of institutional and organizational setups for the project implementation

3) Environmental and social consideration

4) Plant design and engineering

【Power Plant】
a) geographical and topographical survey
b) fuel supply planning
c) configuration of the plant including electrical and mechanical systems
d) basic design of the power plant
e) balance of plant facilities for the power plant

【Transmission/Substation】
f) review of power system planning related to the Project
g) power system stability analysis related to the Project
h) planning of measures for power system stability through survey and analysis of the current power system, drawing up an optimal plan, determining specifications and appropriate installation arrangement for concrete equipment.

5) Formulation of construction plan
a) implementation schedule
b) procurement packages
c) transportation planning

6) Cost estimation including market price survey for equipment and materials

7) Economic and financial analysis

8) Recommendation on the scope of the ODA loan project

9) Recommendations on project effect indicators

10) Formulation of operation and maintenance plan

11) Estimation of greenhouse gas emission reduction

(2) Survey Area
The target area under this Preparatory survey is the project site for the construction of Yahma Gas Fired Combined Cycle Power Plant. The project site is Yashma, Sumgayit city, Azerbaijan. The location of the Yashma project Site is shown in Figure 1.2-1. Figure 1.2-2 shows the area of the Yashma Project Site.

Source: Google earth

Figure 1.2-1 Location of Yashma Project Site

Source: Google earth

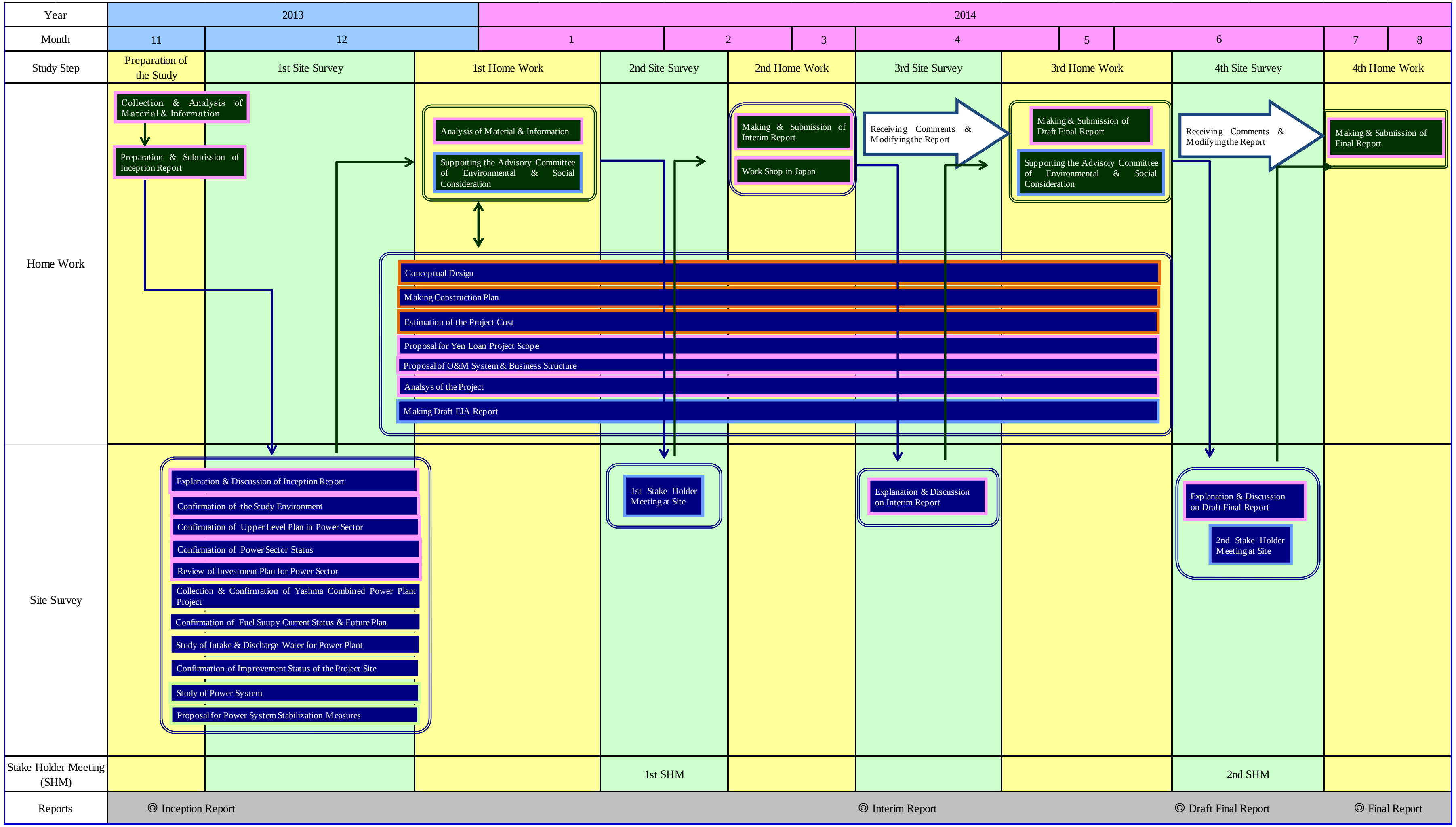
Figure 1.2-2 Area of Yashma Project Site

(3) Counterpart
Azerenerji Joint Stock Company (JSCA)

1.2.3 Duration of the Study

(1) Period
November 2013 – August 2014
(2) Reports
1) Inception Report
Middle of November 2013
2) Interim Report
First of April 2014
3) Draft Final Report
Middle of June 2014
4) Final Report
Middle of August 2014
(3) Stakeholder Meeting
Holding of two (2) times
(4) Work shop in Japan
March, 2014

Schedule of the Study is shown on the next page (See Figure 1.2-3).



Source: Study Team

Figure 1.2-3 Schedule of the Study

1.3 Organization of the Team

Table 1.3-1 shows the names and duties of study team members.

Table 1.3-1 Organization of the Team

Assignment	Name
Team Leader /Thermal Power Engineer	Mr. Sachio KOSAKA
Development Planning Engineer	Mr. Hitoshi FURUKOSHI
Power System Analyst	Mr. Nobuyuki KINOSHITA
Mechanical Engineer (GT/ST)	Mr. Katsunori SHIMAYA
Mechanical Engineer (HRSG/BOP)	Mr. Tomoyuki KONDO
Fuel Planning Engineer	Mr. Masayoshi ONO
Electrical and I&C Engineer	Mr. Masaho AOKI
Civil Engineer (Planning)	Mr. Hirokazu SAKURAOKA
Senior Civil Engineer (Field Survey)	Mr. Naoto AKIKUNI
Transmission Engineer	Mr. Keiji WAKAMATSU
Substation Engineer	Mr. Hiroki TANIHATA
Natural Environmental Analyst	Mr. Norihiko FUKAZAWA
Social Environmental Analyst	Mr. Takashi NAKAMURA
Financial Analyst	Ms. Hisami NAKAMURA

Source: Study Team

Chapter 2

General Overview of Azerbaijan

Chapter 2 General Overview of Azerbaijan

2.1 Overview of the Republic of Azerbaijan

Azerbaijan is one of the Trans-Caucasus republics formed from the breakup of the former Soviet Union. It is bordered by Russia and Georgia to the north, Iran to the south, and the Caspian Sea to the east (See Figure 2.1-1).

Source: Google earth

Figure 2.1-1 Map of the Republic of Azerbaijan

Table 2.1-1 shows an Overview of the Republic of Azerbaijan.

Table 2.1-1 Overview of the Republic of Azerbaijan

1. Name	Republic of Azerbaijan
2. Area	86,600 square kilometers (about one fourth the area of Japan)
3. Population	9,400,000 (according to national consensus of 2012)
4. Capital	Baku
5. Ethnic groups	Azerbaijani (90.6%), Lezgin (2.2%), Russian (1.8%), Armenian (1.5%)
6. Language	Azerbaijani (official language)
7. Religion	Islamic
8. Government system	Republic (President Ilham Aliyev, third term in October 2013 with a term of office of five years)
9. GDP	68,800 million USD (according to FY2012 survey of the IMF)
10. Economic growth rate	2.2% (according to FY2012 survey of the IMF)
11. Price increase rate	1.1% (according to FY2012 survey of the IMF)

12. Currency	Manat (AZN)
13. Major industries	Oil, Natural Gas, Petrochemical product, Iron ore

Source: Ministry of Foreign Affairs, Japan

2.2 Political Situation

Azerbaijan attained national independence from the former Soviet Union in August 1991 following the approval of a new constitution in November 1995.

President Ilham Aliyev first became President of Azerbaijan after winning the October 2003 presidential election. He was re-elected in October 2008. The deletion of a stipulation prohibiting the president from seeking three terms in the constitution by a referendum in March 2009 has enabled the establishment of a long-term administration. The New Azerbaijan Party, led by President Ilham Aliyev, has been the ruling party in Milli Majlis and the political situation of the country has been stable. The last presidential election was held in October 2013. He was elected for a third term.

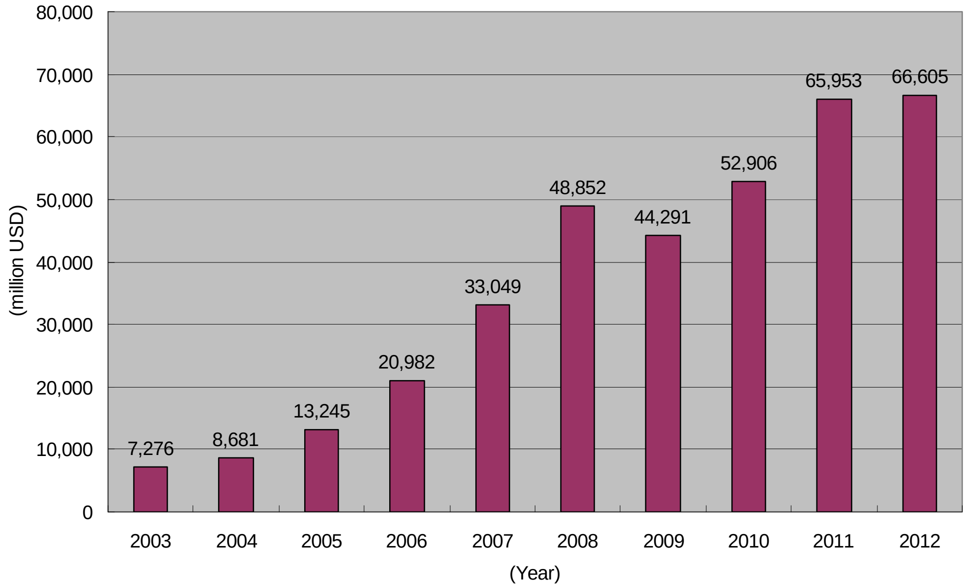
Azerbaijan’s foreign policy has centered on protecting the country’s national interests. At the same time, Azerbaijan has been working actively on “balanced relations” with international partners, including former Soviet Union republics, European countries, and Islamic countries. Also, Azerbaijan has been promoting economic cooperation with neighboring countries, such as Russia, Georgia, Iran and Turkey, in order to exploit its strategic geopolitical location to acquire a competitive advantage, particularly with regard to the exploration of oil and gas production and exports.

Azerbaijan overcame turmoil just after its independence and currently maintains a stable political situation both domestically and internationally.

2.3 Economic Conditions

2.3.1 Macroeconomic Trends

The Azerbaijan economy has grown rapidly over the last decade. At current market prices, Azerbaijan’s Gross Domestic Production (GDP) expanded from around 7 billion USD in 2003 to over 66 billion in 2012 (See Figure 2.3-1). The GDP of Azerbaijan saw double-digit growth for the period from 2003 to 2008, peaking at 34.5% in 2006. The oil and gas sector largely drove the economy before the world economic and financial crisis in 2008. The sector was the leading growth sector, recording prominent annual growth rates of over 40% in 2005 and 2006 while agriculture sector growth has been limited. Massive foreign direct investment (FDI) in the late 1990s stimulated the development of the oil and gas sector, and though this led to rapid and high growth of the hydrocarbons sector, along with the associated construction and services sectors, non-oil related sectors did not benefit. Figure 2.3-1 shows GDP at current USD (2003-2012).

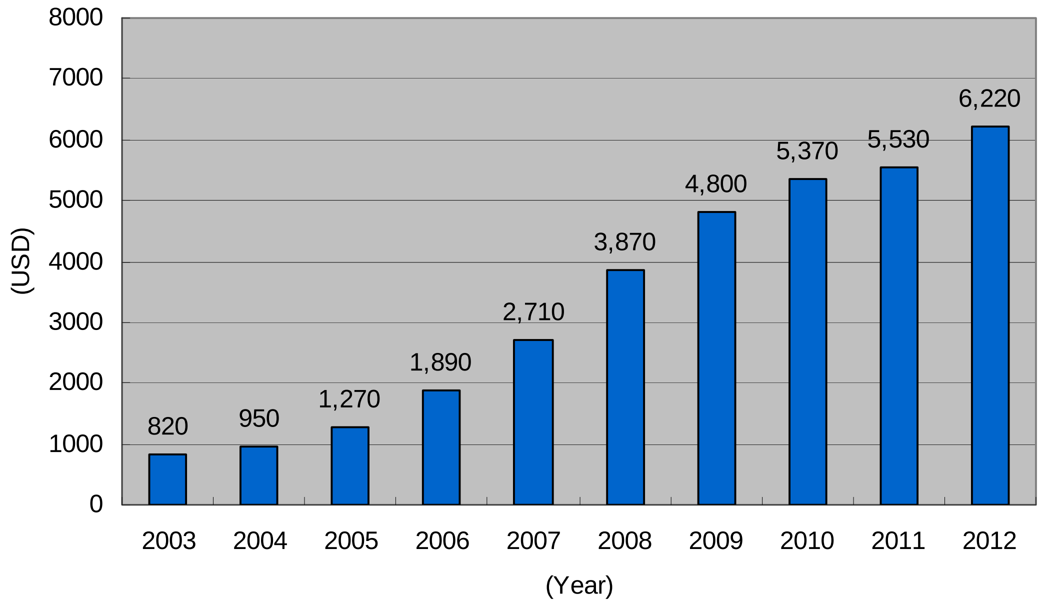


Source: World Bank

Figure 2.3-1 GDP at Current USD (2003-2012)

However, the macroeconomic situation changed after the world economic and financial crisis in 2008. Azerbaijan’s GDP growth slowed to 0.1% in 2011 (See Figure 2.3-2). The economy has been rebalancing due to the contraction of the oil-sector and the expanding non-oil sectors, in particular construction and services, stimulated by rising public expenditure. Non-oil sectors now lead growth.

Strong economic growth driven by the oil and gas sector has generated a rise in Azerbaijan’s per capita income. Gross National Income (GNI) per capita increased from 820 in 2003 to 6,220 USD in 2012. Azerbaijan has been categorized as a upper middle income country by the World Bank. Figure 2.3-2 shows GNI per capita, Atlas method at current USD (2003-2012).



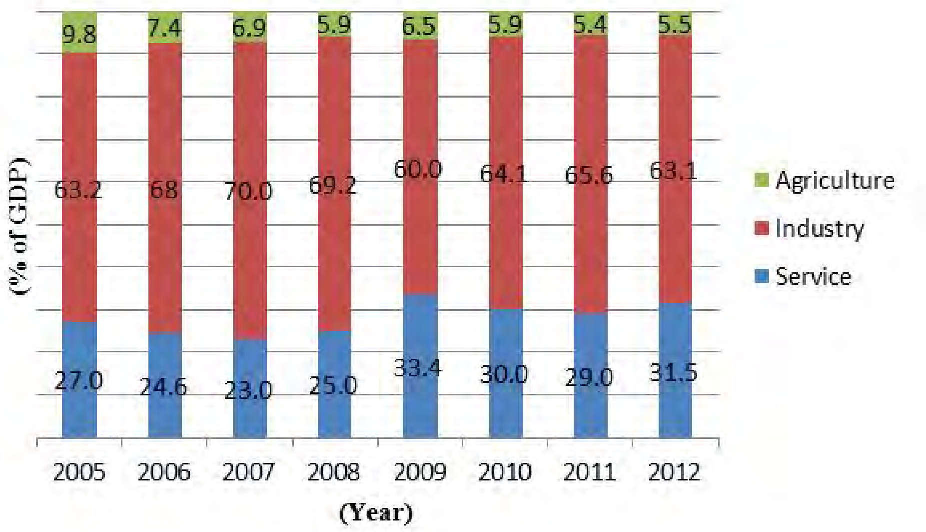
Source: World Bank

Figure 2.3-2 GNI per Capita, Atlas Method at Current USD (2003-2012)

Economic growth has caused an increase in the country's electricity consumption. It expanded to 21,700 GWh in 2006 when the GDP growth rate peaked at 34.5%. However, a slowing economy and rise in electricity tariffs in 2007 resulted in a decrease of electric consumption to 14,400 GWh in 2009 and 2011, although it achieved a recovery to 17,000 GWh in 2012.

The foreign exchange rate of the manat has been appreciating against the US dollar. The annual average climbed from 0.98 AZN per USD in 2002 to 0.78 AZN per USD in 2012.

The industrial sector has occupied the leading share of the GDP, expanding to 70% of GDP in 2007 and still maintains a level of over 60% even after the world economic and financial crisis. The service sector's GDP share is 31.5%, the agriculture sector is 5.5% in 2012.

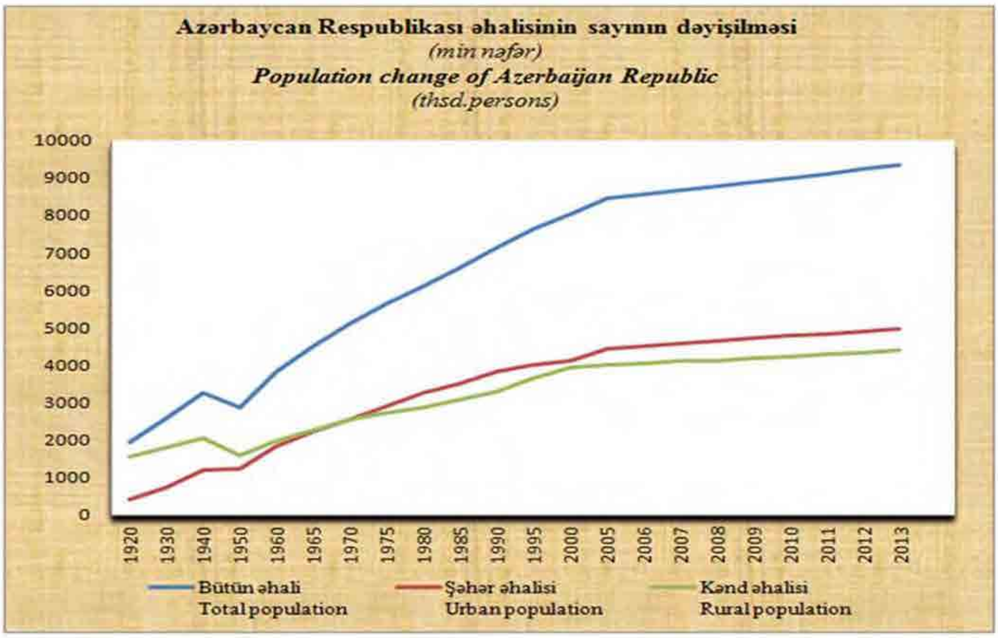


Source: Asian Development Bank, "Key Indicator for Asia and the Pacific 2013"

Figure 2.3-3 GDP Share by Sector from 2005 to 2012

2.4 Social Conditions

The total population of Azerbaijan is shown in Figure 2.4-1, and has risen to more than 9.3 million people as of 2013. The growth rate has remained at around 1.3%, approximately the same as the world average. The population is significantly concentrated in Baku, the country's capital, with 28.7% inhabiting the Absheron region where Baku is located. The second most populous area is Aran, the country's largest economic region, which lies adjacent to Absheron.

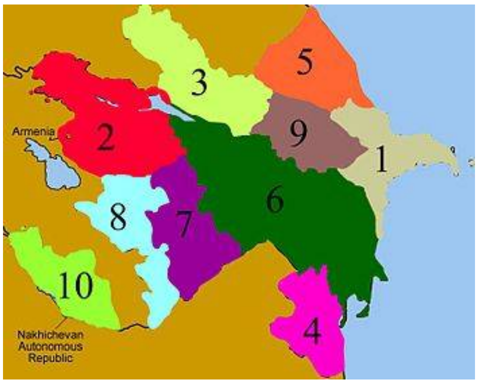


Source: The State Statistical Committee of the Republic of Azerbaijan

Figure 2.4-1 Population Change of Azerbaijan (thsd persons)

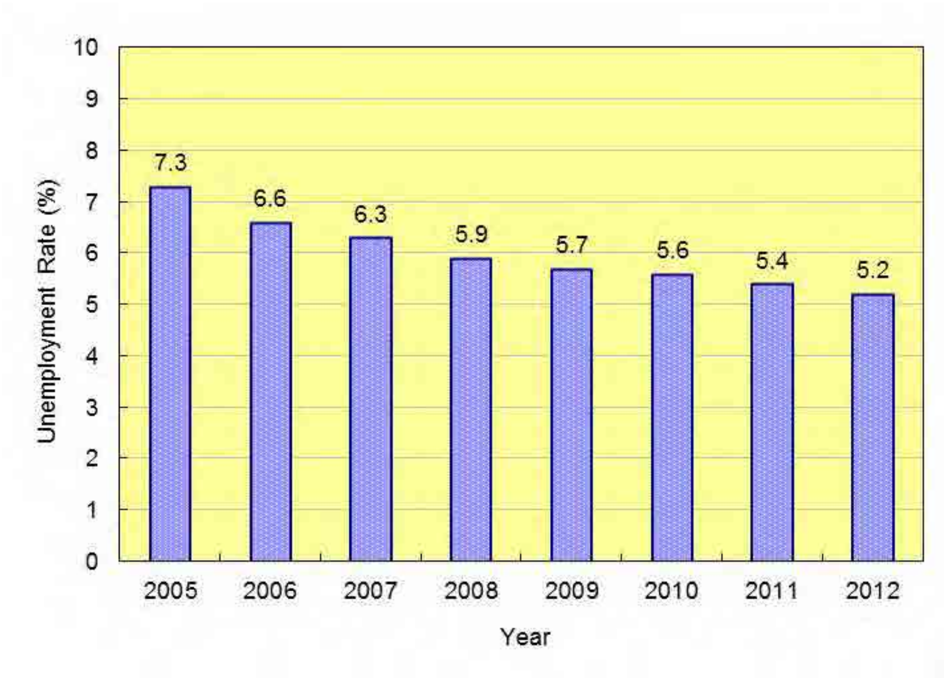
Table 2.4-1 Population of Economic Regions

Economic and administrative regions	Total (x thousand)
1)Baku city	2136.6
1)Absheron	533.7
2)Ganja-Gazakh	1210.6
3)Shaki-Zaqatala	584.6
4)Lankaran	862.0
5)Guba-Khachmaz	508.5
6)Aran	1875.5
7)Yukhari-Karabakh	632.8
8)Kalbajar-Lachin	234.7
9)Dakhlik-Shirvan	293.9
10)Nakhichivan	422.9



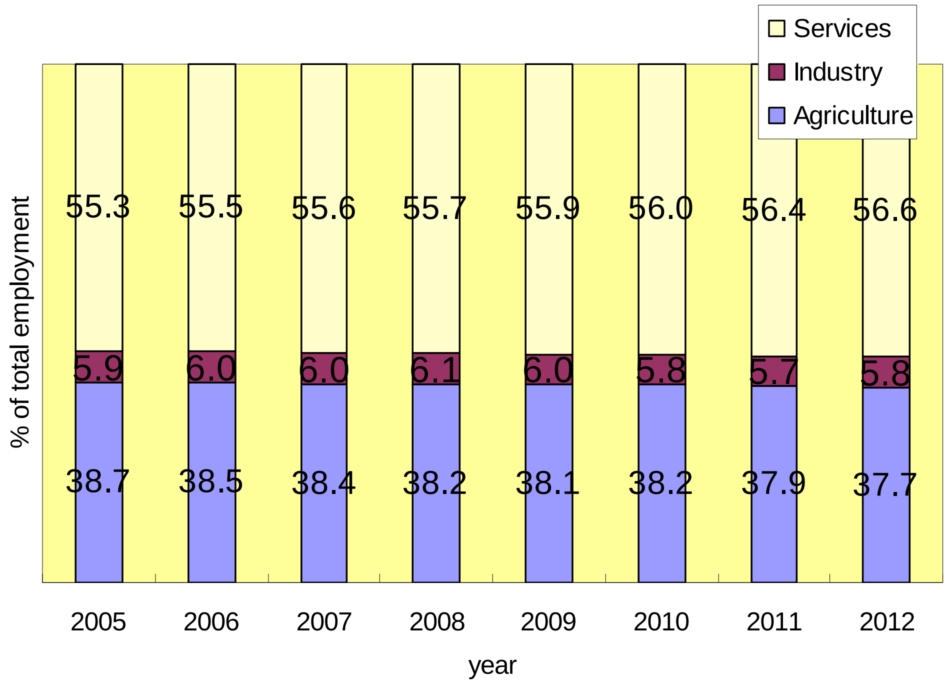
Source: The State Statistical Committee of the Republic of Azerbaijan

The unemployment rate has decreased from 7.3% in 2005 to 5.2% in 2012 (Refer to Figure 2.4-2). The labor force engaged in industry and agriculture has been decreasing since 2005. Only the service industry has shown signs of slight expansion.



Source: Key Indicators for Asia and the Pacific 2013

Figure 2.4-2 Unemployment Rate

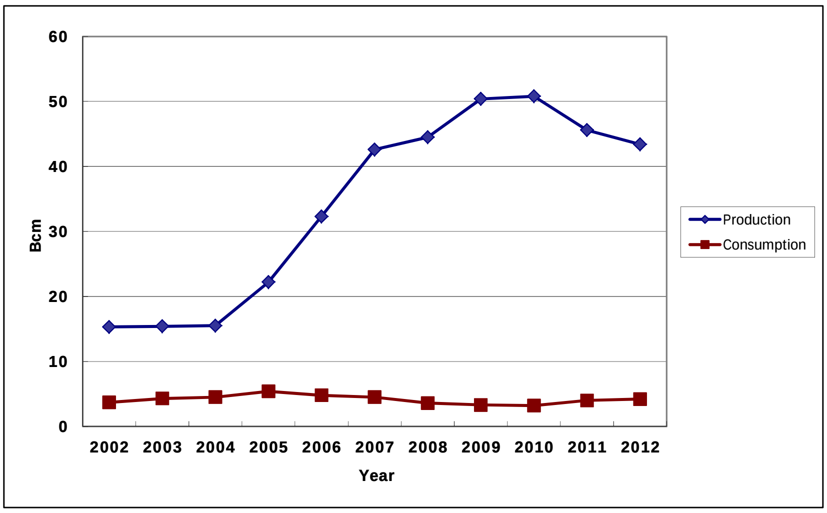


Source: Key Indicators for Asia and the Pacific 2013

Figure 2.4-3 Labor Force

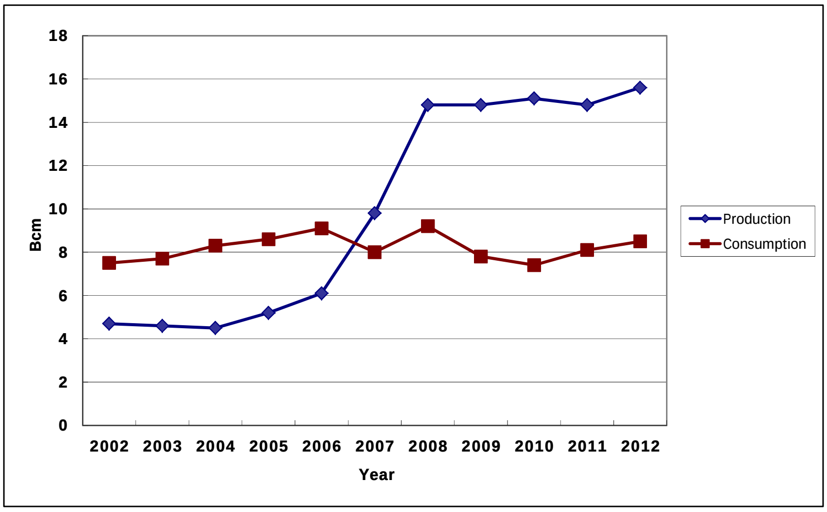
2.5 Oil / Gas Production

Actual records of production, domestic consumption of oil and natural gas are shown in Figure 2.5-1 and 2.5-2.



Source: BP Statistical Review of World Energy June 2013

Figure 2.5-1 Oil Production and Consumption



Source: BP Statistical Review of World Energy June 2013

Figure 2.5-2 Natural Gas Production and Consumption

Azerbaijan is one of the world's oldest oil producing countries. According to a report by British Petroleum (BP) in 2013, Azerbaijan currently possesses seven (7) thousand million barrels of proven oil reserves, and there are also large additional reserves offshore in the Caspian Sea. Domestic oil consumption has been declining gradually. When oil extraction moved into a new phase from 2005, production and export increased drastically. There are three (3) international networks of oil pipelines in Azerbaijan. The first is the Baku-Tblisi-Ceyhan pipeline to Turkey through Georgia. The second is the Baku-Supsa pipeline to Georgia. And the last is the Baku-Novorossiyak pipeline to Russia.

Production of natural gas has increased since 2007 due to large-scale capital investment, and Azerbaijan began to export gas to Georgia and Turkey from the Shah Deniz gas field in the Caspian Sea. Approximately 70km southeast of Baku, it is the largest natural gas field in Azerbaijan. There are three (3) international gas pipeline networks in Azerbaijan. The first is the South Caucasus pipeline to Turkey through Georgia. The second is the Kazi Magomed-Astara-Abadan pipeline to Iran. And the last is the Mozdok-makhachakala-Kazi Magomed pipeline to Russia. In the past, any domestic consumption shortages were supplemented by imports. Since 2007, production increased and the surplus was turned into exports. Currently, domestic natural gas is used for power generation. Chapter 6 describes the Fuel Supply Plan of Natural Gas required for the implementation of the project.

Chapter 3

Current Situation in the Electric Power Sector

(A part of this chapter has been removed because of confidential information.)

Chapter 3 Current Situation in the Electric Power Sector

3.1 Institutional Framework of the Electric Power Sector

In Azerbaijan, the Ministry of Energy plays a key role in the energy sector, and is in charge of the implementation of national energy policy regulations and decrees. Meanwhile, the Tariff Council regulates prices and tariff methodology.

Historically, “Soviet Power Engineering and Electrification Azerenergy Production” was engaged in the electric power industry during the Soviet era. After independence, control was transferred to Azerenergy State Company in 1993, becoming Joint Stock Company Azerenerji “Azerenerji JSC” a 100% state owned company established in 1996.

An attempt of re-organization of power sector was made from 2000. The distribution sector was separated from Azerenerji JSC and four companies were established, including Baku Electric Grid JSC, Ganja Electric Grid JSC, Alibayramli Electric Grid JSC, and Sumgayit Electric Grid JSC. As the second step for rationalization, management rights of Baku and Sumgayit distribution JSCs were transferred to Barmek, a Turkish company, under a long-term management contract. For the rest of the two distribution JSCs, management right of Ganja and Ali-Bayramli was transferred to Bayva, a Azerbaijan company, under a long-term management contract (25 years concession) in 2002.

Unfortunately the performance of the private distribution companies was unsatisfactory; as a result, the distribution business was transferred to Baku Electric Grid JSC in Baku city and the surrounding area and to seven of Azerenerji JSC’s subsidiary companies. Integration into Azerenerji JSC then took place. Nowadays, therefore, Azerenerji JSC and Bakielektrikshebeke JSC (Baku Electric Distribution Company), both state owned companies, are the main players in the electric power industry.

The Baku Electric Distribution Company is responsible for electricity distribution and sales in the Baku region, where the country’s capital city is located, and where more 50% of the entire country’s electricity is consumed. Azerenerji JSC owns major generation plants and transmission systems, and also provide electricity as a power systems operator. The company is also an electricity distributor and seller for the whole mainland, except for the Baku region.

Azerenerji JSC, one of the largest companies in Azerbaijan, employs 14,996 people including 443 people working at the head office as of April 2014. Azerenerji JSC has undertaken the comprehensive challenge of improving efficiency, fiscal transparency and accountability etc. including organization reform. The current organization structure of Azerenerji JSC is as shown in Figure 3.1-1.

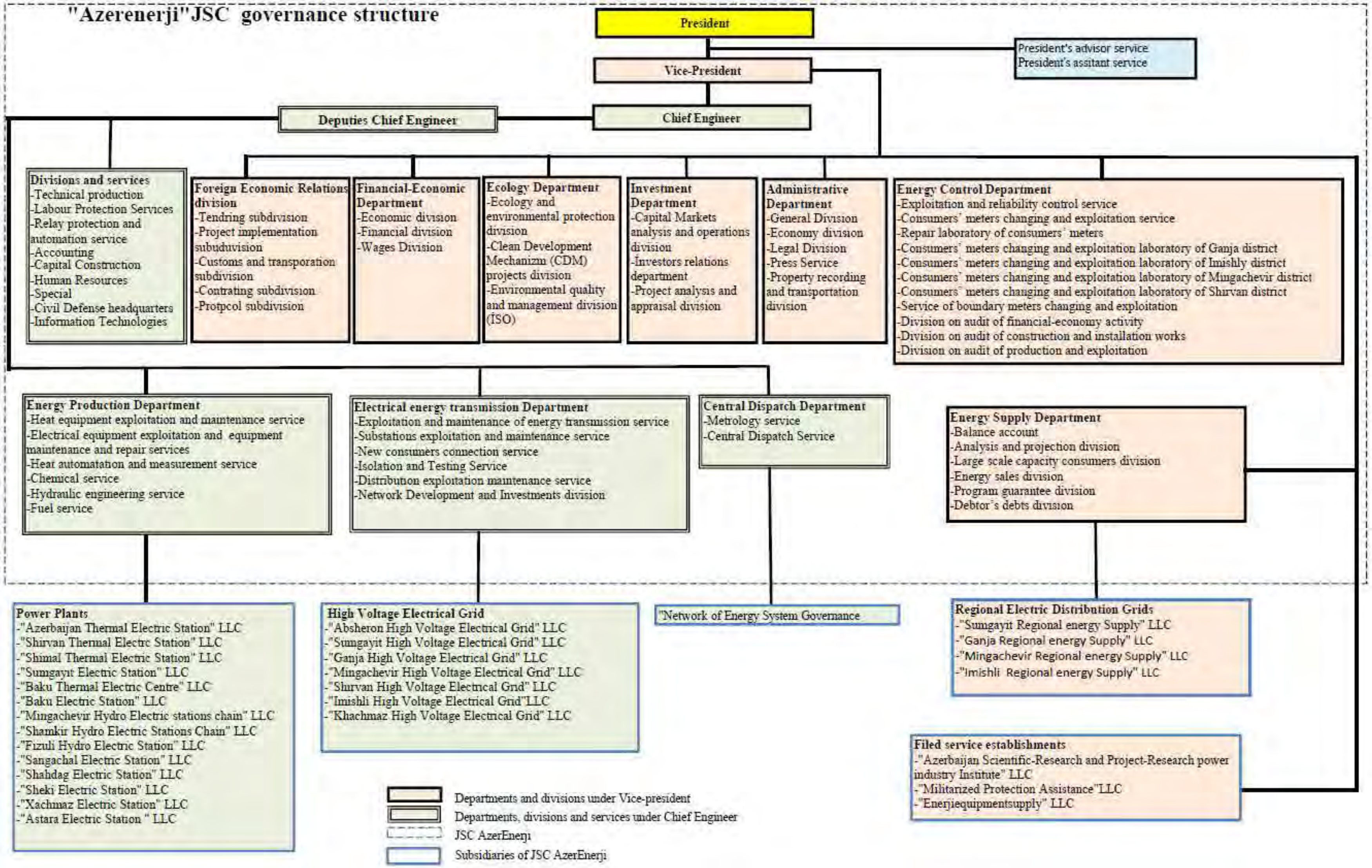


Figure 3.1-1 Azerenerji JSC Governance Structure

3.2 National Policies for the Electric Power Sector

3.2.1 State Development Program for the Fuel and Energy Sector (2005-2015)

The Presidential decree of "State program for development of fuel and energy sector in Azerbaijan (2005-2015)" dated February 14, 2005, is a central policy of the government. The overall goal of this state program is to fully meet the electric power, gas and other energy demand of both the population and economy through the continued development of the fuel and energy sector. The specific objectives and development targets are described in it. This state program, which sets out targets and principal objectives, is currently ongoing but a revision is underway.

The primary fuel for electric power plants identified under the program in the upcoming period is natural gas. The program also mentions that mazut (fuel oil) is planned to consume about 15-20% of the fuel supply for electricity generation, but purpose of usage is limited only for the use of regulating generation and emergency backup in case of outages of the gas system. Consequently, the recent use of mazut (fuel oil) for power generation has been limited (only 2.3% of fuel consumption in 2012). Azerenerji JSC has estimated and submitted a fuel consumption plan for generation using only natural gas. Nowadays, therefore, natural gas can be viewed as the main fuel for power generation in Azerbaijan.

3.2.2 Development Concept of the Power Sector

The Presidential decree of the "State program for socio-economic development of the Baku city and its settlements in 2014-2016 year" was approved in January 2014.

The further improvement of electricity supply, based on the results of successful implementation in 2011-2013, is one of the objects that will be achieved as a result of implementation of the said program. The rehabilitation / modernization of existing thermal power plants and the construction of new plants are described as a major direction of the program. Azerenerji JSC and Baku Electric Distribution Company are nominated as executors in their tireless efforts for the further improvement of the electric power supply.
The name of specific projects is not mentioned in this program but it is believed that Azerenerji JSC and Baku Electric Distribution Company are to play central roles as executors in the electric power sector.

3.2.3 Regional Development Plans

Development of non-oil sector is one of the basic directions of the economic development concept in Azerbaijan. Large-scale development projects are planned and some infrastructural projects have been underway near the surrounding area of Baku.

(1) Sumgayit Technologies Park

Sumgayit Technologies Park (STP) – occupying 45 hectares of land - is a large-scale modern industrial park located in Sumgayit city.

According to a plan commencing in 2011, industrial production lines, workshops and plants are constructed here. More than 2,300 people were involved in construction of the first stage of the industrial park. In the plan, more than 3,000 personnel, including highly-qualified engineers will continue to work here.

Factory production of electric power cables for 110/132/154kV is already underway and the export of production to the world market has commenced.

(2) Baku White City project
Baku White City is one of the largest projects to re-develop an oil industrial site located east of the Baku city center, across an area of 221 hectares. Development of 18,000 residential and commercial units, a fountain park, an entertainment center, and a new metro station and so on are planned and construction began in 2010.

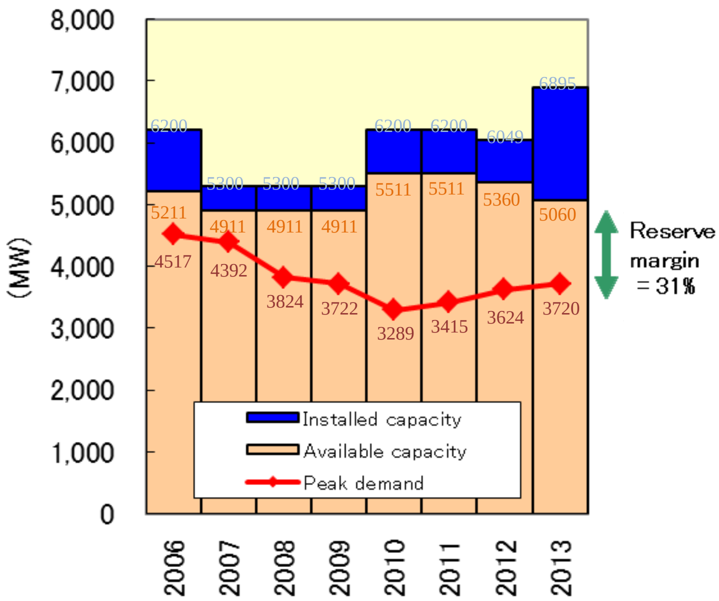
(3) New Baku international sea port
A large-scale development project to replace the Baku Sea Port has already started in the Absheron economic region from December 2010. The New Baku International Sea Port is planned to be built in Alyat, 65km south of Baku.
Alyat is located at the crossroads of major East-West and North-South transportation corridors, where Azerbaijan's main railways and highways networks meet together. The new Sea Port is expected to be a base for efficient distribution including neighboring countries, and it will also be a trigger to attract industrial factories in the surrounding areas. The first phase of construction is planned to be completed by 2014, and dredging work has already started at the site.

3.3 Electric Power Supply

3.3.1 Supply / Demand Balance

The relationship of installed / available capacity and annual peak demand is shown in Figure 3.3-1. Since peak demand of electric power has been on the decrease from 2007 to 2010, electricity demand has not yet recovered. However, there has been a steady increase in the past four years.

Installed capacity increased in 2013 with the Janub thermal power plant starting to generate, but available capacity has been decreasing due to aging of existing TPPs. The reserve margin has been decreasing drastically. Therefore, preparation of additional power supplies appears to be necessary because the construction of a power plant will take a long time.



Source: JSCA

Figure 3.3-1 Supply / Demand Balance

3.3.2 Current Situation of Power Supply

(1) Power Generation Capacity and Generation Record

The Janub combined cycle thermal power plant finally started operation in 2013 – this was a highly anticipated event for Azerbaijan's power system. In response to this, the Shirvan TPP, an aging facility with quite low efficiency, was retired.

Installed capacity of the existing power plants of the Azerbaijan grid is shown in Table 3.3-1. The total capacity was 6,860 MW in 2014 and about 86 % of that was shared with thermal plants, including gas-engine plants. The annual generation record of each plant is also shown in the table. The percentage of thermal power to total installed capacity is considerably high but share of the thermal power generation is almost the same as the installed capacity ratio.

(2) Independent Power Producers

There are Independent Power Producers (IPPs) in Azerbaijan as shown in Table 3.3.2. The type of generation is varied; thermal power, small hydropower, wind power, solar power and biomass. Generation of these IPPs is about 1,800 GWh in 2013, which is about 9% of generation of Azerbaijan grid. Most of them are not connected to the national grid and are supplied to the customers independently. The development of renewable energy will not be easily attained due to instability and high cost of these generation methods.

The Law on Energy in Azerbaijan provides the basic legal schemes for the energy sector. The Law on Electric Power sets out provisions for small power plant, industrial power plant, transmission and distribution facilities as well as large utility power plants. In the electricity supply business tariff shall be determined by the resolution of Tariff (Price) Council. Chairman of the Council is Ministry of Economic Development, and other members are relevant Ministries and Committees such as Ministry of Finance, Ministry of Taxes, Ministry of Justice, Ministry of Energy etc.

The private capital investment will not be forthcoming in renewable energy development from an institutional and regulatory perspective in Azerbaijan at this moment.
Azerbaijan does not have a dedicated renewable energy law as yet. The agency of Ministry of Energy in cooperation with United Nations Development Program (UNDP) launched a project for promoting development of renewable energy and activities including drafting of Law on Renewable Energy, F/S for small hydropower, economic assessment of wind, solar and biomass energy etc. have been conducted.

The major policy document "Renewable energy strategy" was adopted in 2004 and a new strategy"National Strategy for the Development of Alternative and Renewable Energy Sources in 2012-2020" is to be prepared for the following objectives;
- To create truly sustainable energy system for Azerbaijan
- To prepare and present national strategy for the use of alternative and renewable energy
- To determine key directions for the production of electrical and thermal energy from renewable
- To create the legal framework for the usage of renewable energy
- To establish optimal conditions for the promotion of renewable energy sector

As for feed-in tariffs for renewable -based energy, a preferential tariff rate has been established for wind. The existing rate for small HPPs is lower than the standard rate.

These rates are not high enough to attract private investors to the sector and introduction of flexible tariffs would be required for the promoting of development of renewable energy. There are no specific regulations concerning grid access for renewable-based power producers, obligation to purchase electricity from those producers by grid company at this moment and these issues are individually addressed on ad hoc basis.

(3) Load factor of each power plant

Figure 3.3-2 shows the load factor of each power plant. Shimal CCPP and Sumgayit CCPP, which has the higher efficiency, record the higher load factor almost every year.
Ideally a higher load factor should be achieved by the high efficiency plant form the view point of energy efficiency. Therefore, this record seems reasonable.

Table 3.3-1 Installed Capacity and Annual Generation

No.	Power Plant	Type	Year of 1st unit operation	Installed capacity in 2014		Available capacity in 2014		No. of units	Annual Generation <Sending end> (GWh)									Capacity Factor in 2013(%)
				MW	%	MW	%		2006	2007	2008	2009	2010	2011	2012	2013	%	
1	Azerbaijan	BTG	1981	2,400		2,100		8	11,131	9,273	8,822	6,481	5,008	6,037	7,824	7,344		34.9%
2	Shirvan	BTG	1962	900		255		7	5,255	4,242	3,813	2,439	2,324	2,526	2,648	2,280		28.9%
3	Shimal	CC	2002	400		320		1	2,571	2,161	2,592	2,272	2,125	2,110	1,963	1,855		52.9%
4	Sumgayit	CC	2009	525		450		1x(2GT+1ST)	–	294	982	1,783	2,182	1,989	2,837			61.7%
5	Janub	CC	2013	780		720		2x(2GT+1ST)	–	–	–	–	–	–	1,108			16.2%
6	Baku	CH	1973	106.6		80		2	652	467	429	362	297	410	515	510		54.6%
Thermal Sub-Total			–	5,112	75%	3,925	78%		19,609	16,143	15,950	12,536	11,537	13,265	14,939	15,934	79%	35.6%
7	Baku ES	D	2007	104.4		85		12	–	469	612	541	463	531	564	507		55.4%
8	Astara ES	D	2006	87		60		10	315	425	415	315	200	257	285	255		33.5%
9	Xacmaz ES	D	2006	87		64		10	57	431	404	203	232	332	379	263		34.5%
10	Shaki ES	D	2006	87		60		10	136	391	329	271	162	209	303	305		40.0%
11	Sangachal ES	D	2008	299.6		175		18	–	–	19	1,332	1,172	1,231	1,447	1,231		46.9%
12	Shadag ES	D	2009	104.4		95		12	–	–	–	56	226	283	331	298		32.6%
Gas Engine Sub-Total				769	11%	539	11%		508	1,716	1,779	2,718	2,455	2,843	3,309	2,859	14%	42.4%
13	Mingechevir	H	1953	401.6		260		6	1,292	926	935	801	1,656	1,139	753	415		11.8%
14	Vavara	H	1956	16.5		0		3	104	88	78	78	59	4	0	0		0.0%
15	Shamkir	H	1982	380		200		2	801	906	831	933	1,108	952	631	570		17.1%
16	Yenikand	H	2000	150		130		4	309	331	296	370	463	380	275	250		19.0%
17	Fuzuli	H	2013	25		8		2	–	–	–	–	–	–	–	22		10.0%
18	Small HPPs	H	2013	6		1		3	–	–	–	–	–	–	–	3		5.7%
Hydro Sub-Total			–	979	14%	599	12%	–	2,506	2,251	2,140	2,182	3,286	2,475	1,659	1,260	6%	14.7%
Total Capacity			–	6,860	MW	5,063	MW	–	–	–	–	–	–	–	–	–		–
Total Generation - Azerbaijan Grid			–	–		–		–	22,623	20,110	19,869	17,436	17,278	18,583	19,907	20,053	GWh	33.4%

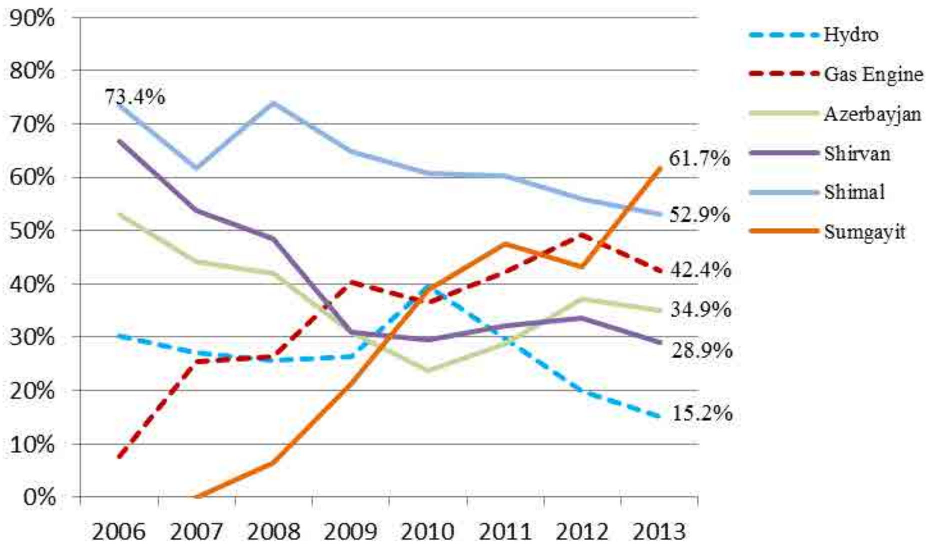
Source: JSCA

Note:
- BTG: Conventional
- CC: Combined Cycle ("CCPP")
- CH: Combined Heat and Power
- D: Diesel/ Gas Engine
- H: Hydro, Small HPPs : Goychay-1SES, Qusar-1 SES, and Ismayilli-1 SES

Table 3.3-2 IPP Power Plants in Azerbaijan

Type	Power Plant	Annual Generation (GWh)	
		2013	2014 (plan)
Thermal	BP Azerbaijan	1,345	1,700
	ARDNS	213	240
	Azerbaijan Sekir Istehsalat Birliyi MMC	74	74
Hydro	Seki Kicik SES	6	7
	Mugan Kicik SES	13	14
Wind	Kaspian Texnoloji Sirketi	0	0
	Qobustan ETTM	1	1
	Alten Group	0	24
Solar	Gunes ES	1	2
Biomass	Berk Maiset Tullantilarmm Yandirilmasi Zavodu	137	201
	Qobustan ETTM in biogas	0	0.0
	Total	1,790	2,263

Source: JSCA



Source: JSCA

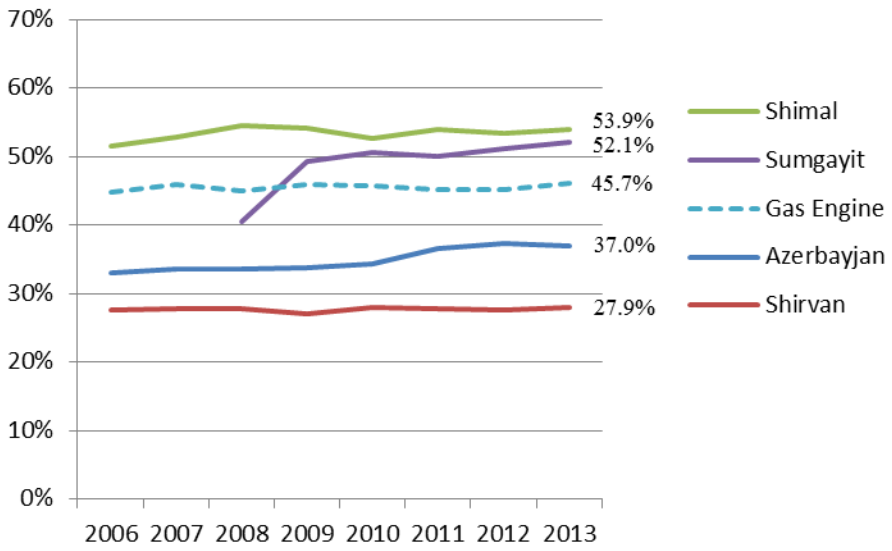
Figure 3.3-2 Load Factor of Each Power Plant

(4) Average Thermal Efficiency

Figure 3.3-3 shows the average efficiency of each thermal power plant over a 7-year period. The thermal efficiency of combined cycle plants (Shimal and Sumgayit) is far higher than that of conventional steam turbine plants (Azerbaijan and Shirvan). The efficiency of the Azerbaijan TPP increased from 2011. This seems to have been the result of a rehabilitation project at the Azerbaijan TPP supported by EBRD. Thermal efficiency of gas engine plants, meanwhile, lies in the middle of both types of thermal power plants.

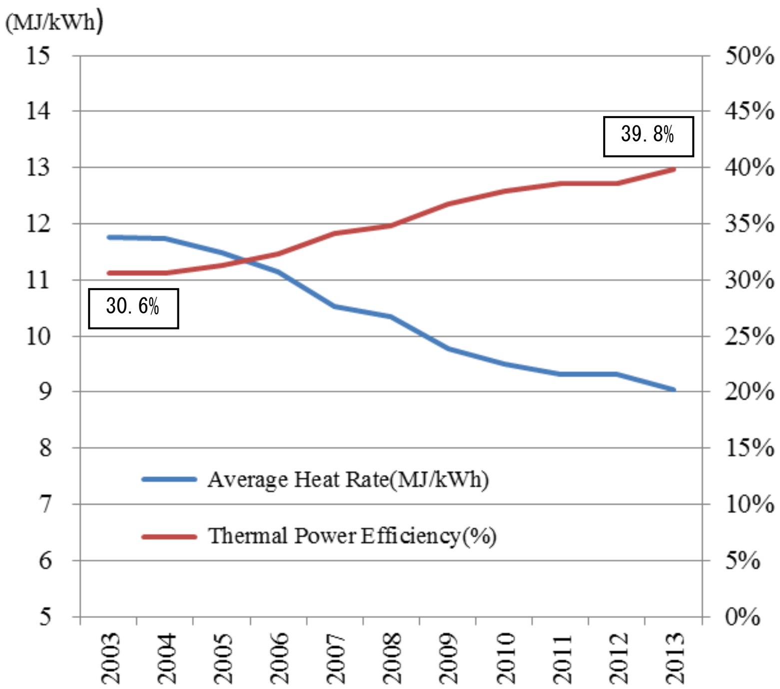
Figure 3.3-4 shows a successful improvement in average thermal efficiency of the plants overall. There was a relative improvement of 30% over the last 10 years (from 30.6% in

2003 to 39.8% in 2013) by introducing high efficiency plants such as CCPP and Diesel/Gas Engines. In the near future, there will be further improvements following the start of operations at the Janub 780 MW CCPP and Shimal 2nd 400 MW CCPP.



Source: JSCA

Figure 3.3-3 Efficiency of Existing Thermal Power Plants



Source: JSCA

Figure 3.3-4 Average Thermal Efficiency

3.3.3 Main Issues of Power Sector

The "Study for electric power sector in Azerbaijan" was carried out by JICA in 2013, and issues facing the power sector for securing stable power supplies in the future were pointed out as recommendations of the study. The main points were as follows.

- Ensuring power supply capacity;
    - Timely commissioning of currently under construction power plants as scheduled
    - Immediate start of development of new 18,000 MW power plants to meet future power demand in 2018-2020
    - New plant development near Baku area where electricity demand is high, from the viewpoint of avoiding risks of long distance power transmission and contribution to the stability of the power system
    - Confirming stability of power transmission lines and substations, considering 330kV transmission lines and substations
- Improvement to realize a highly stable power system;
    - Voltage Control such as VQC with SVC system
    - Frequency Control based on survey and analysis of current power system

3.4 Current Situation of Ongoing Projects

3.4.1 Power Generation Plants

Azerenerji JSC is presently overseeing the Shimal 2nd CCPP Project and finished the Janub CCPP Project successfully at the end of 2013; this power plant continues to maintain stable operation since commercial operation started.

(1) Shimal CCPP Construction Project

Table 3.4-1 summarizes an outline of the Shimal 2nd CCPP Project. Azerenerji JSC has been constructing one combined cycle unit (2nd unit) for the Shimal CCPP. Shimal CCPP construction project (1st unit) is a successful project as a result of good cooperation between Azerbaijan and Japan, and the Shimal 2 CCPP project is also being implemented in collaboration with JICA.

The owner's consultant is a Japanese company and the main engineering company is also a Japanese company for Shimal 2nd CCPP Project. The GT and ST supplier is Mitsubishi Heavy Industries Co., Ltd. and the generator supplier is Mitsubishi Electric Co., Ltd. The HRSG supplier is Nooter Eriksen Co., Ltd. Electrical equipment is mainly supplied by Siemens AG. Azenco is in charge of procurement of the balance of plant equipment and construction works.

Table 3.4-1 Outline of Shimal 2nd CCPP Project

Location	Shuvelan district (40 km east of Baku)
Power Output	400 MW
Plant Type	CCPP
Fuel	Natural Gas
Construction Start	March 2011
Expected COD	2014 end
Financial Source	Japanese ODA Loan
Status (as of February 2014)	Finished installation of main equipment. Preparing power receiving.

Source: JSCA

Figure 3.4-1 Main Control Building

Figure 3.4-2 Turbine Building and HRSG

Azenco has constructed the base for the power trains (i.e., GT, ST and Generator). Installation of the main equipment and construction of the turbine building is ongoing. Azenco will assemble the HRSG while continuing to construct the turbine section. GT, ST and the Generator were transported to the site in November and December, 2012.

During the operation of the Shimal 1st unit, there was a problem of seaweed intrusion into the water intake and this caused some forced outages of the plant. In order to create countermeasures to prevent the intrusion of seaweed, the installation of a deep-water intake tower system for both units 1 and unit 2 is under construction.

(2) Janub CCPP Construction Project

Table 3.4-2 summarizes an outline of the Janub CCPP Project. Construction of the power plant finished in November 2013 and two blocks of combined cycle units are now operating near full load in a stable manner controlled by a central dispatching center.

Table 3.4-2 Outline of Janub CCPP Projects

Location	Suburb of Shirvan city Adjacent to Shirvan TPP (120 km southwest of Baku)		
Power Output	780 MW		
Plant Type	CCPP		
Fuel	Natural Gas, Heavy Oil (Mazut)		
COD	November 2013		
Financial Source	Islamic Development Bank, commercial banks, etc.		
Status (as of February 2014)	Commercial Operation		
Commencement Date of Commercial Operation	No.1 Block	No.1 GT	11th Oct. 2013
		No.2 GT	27th Sep. 2013
		No.1 ST	20th Nov. 2013
	No.2 Block	No.3 GT	13th Aug. 2013
		No.4 GT	15th April 2013
		No.2 ST	6th Aug. 2013

Source: JSCA

Figure 3.4-3 Overview

The gas turbine (“GT”) supplier is GE. GT is an original machine made by the GE factory, which means it is not a manufacturer’s licensed machine. The GIS supplier is Alstom, the main switchgear supplier is AREVA, the steam turbine (“ST”) supplier is a Chinese company, Harbin Turbine Co., Ltd, and the HRSG supplier is a Chinese company. The equipment appears clean and well manufactured, on par with that used for other international projects.

Figure 3.4-4 Gas Turbine

Figure 3.4-5 Steam Turbine

Figure 3.4-6 HRSG

Figure 3.4-7 Main Control Room

The owner's consultant and the main engineering companies were both Chinese companies.

3.4.2 Transmission Systems

Transmission lines and substations currently under construction and development plans in the 'Study for Electric Power Sector in Azerbaijan, Final report, May 2013' are shown in Tables 3.4-3 and 3.4-4.
Most of the projects have been completed as planned and the projects will start service in 2014.

Table 3.4-3 New Transmission Lines under Construction

Voltage (kV)	Section of Transmission Line	Length (km)	Planned Completion Year	Completion Year

330	Granboy P/M - Imisli S/S	165.5	2013	2013
220	Maslli S/S - Astra S/S (Iran)	8.5	2013	2013
	Simal E/S - Hovsan S/S	25.5	2013	2013
	Shimal E/S - Zabrat S/S	36.8	2012	2013
	Zebrat S/S - Smgayit E/S	38	2012	2013
	Mingecevir E/S - Abseron S/S	222.7	2012	2013
	Absheron S/S - Boyuk Sor S/S	45	2013	2014
	Sirvan S/S - Sangacal S/S - Boyuki Sor S/S	135	2013	2014
110	Sangacal S/S - Musfiq S/S	38.8	2012	2013
	Xacmax E/S - Sahdag S/S	33.2	2013	2013
	Sahdag E/S - Sahdag S/S	30.2	2012	2013

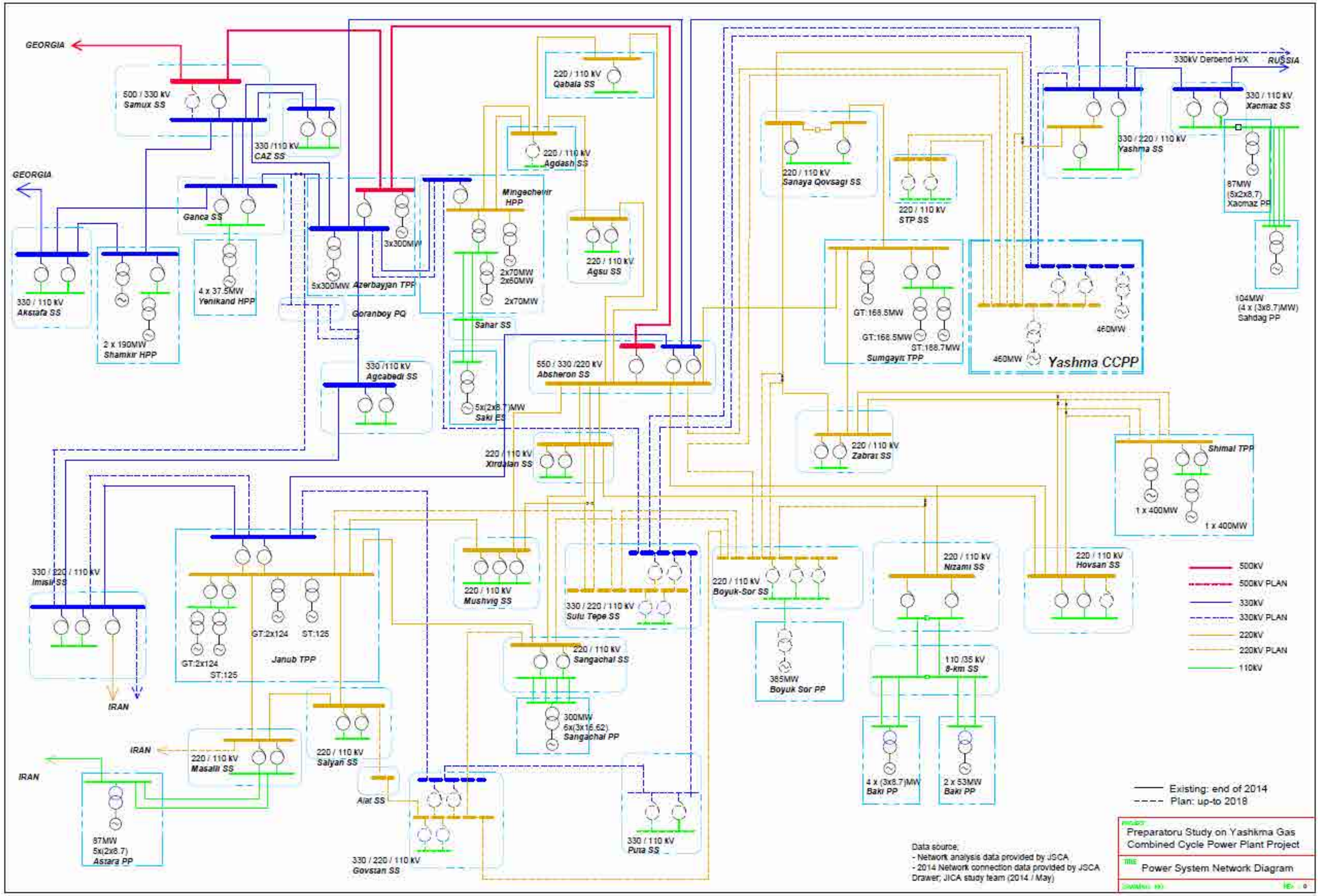
Source: JSCA
S/S: Substation
P/M: Switch Yard
E/S: Power Station

Table 3.4-4 New Substations under Construction

Voltage (kV)	Name of Substation	Capacity (MVA)	Planned Completion Year	Completion Year
220	Agdas	360 (2x180)	2012 - 2013	2013
330	Goraboy	-	2012 - 2013	2013
220	Boyuk-Sor	750 (3x250)	2012 - 2013	2013
220	Zabrat	360 (2x180)	2012	2013
110	Batil-Yeraltl	240 (3x80)	2012 - 2013	2013

Source: JSCA

The Power System Network Diagram including ongoing projects is shown in Figure 3.4-8.



Source: JSCA

Figure 3.4-8 The Power System Network Diagram

3.5 Business / Financial Analysis and Electricity Tariff

This part has been removed because of confidential information.

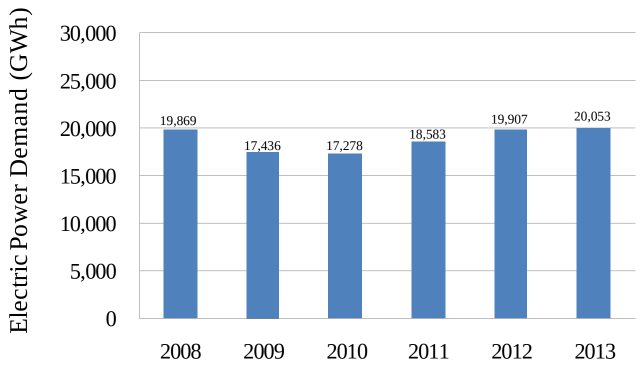
Chapter 4

Review of the Development Plan

Chapter 4 Review of the Development Plan

4.1 Electric Power Demand Forecast

Electric power demand in Azerbaijan trended downward until 2010 due to an increase in electricity tariffs and the promotion of improvements such as smart meters. The trend changed and has risen from 2011, with demand increasing by about 7% per year over three years (2011-2013), which is a high rate.

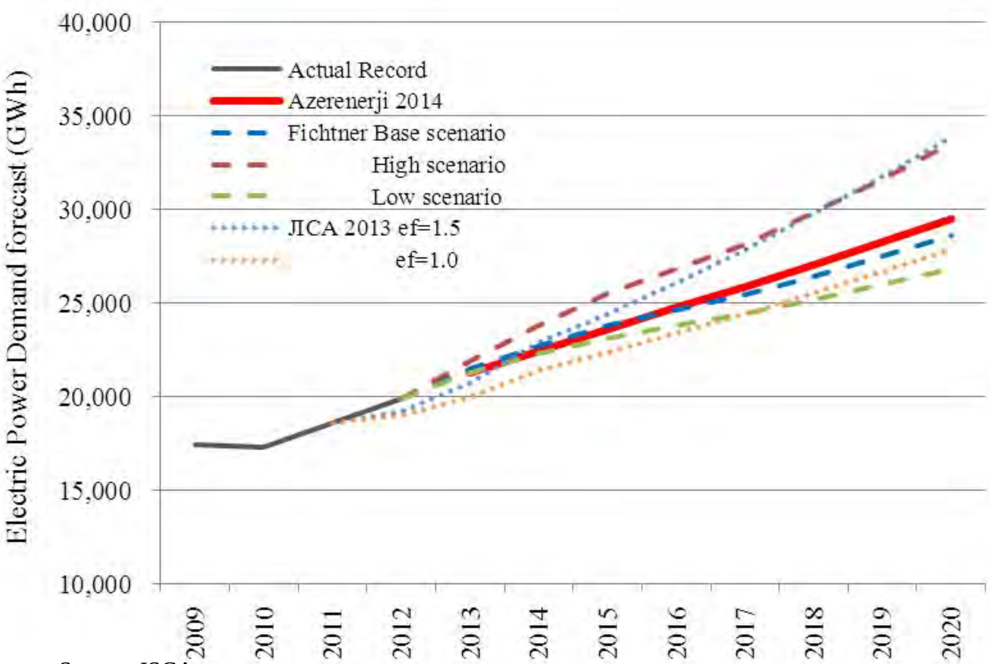


Source: JSCA

Figure 4.1-1 Electric Power Demand of Azerbaijan

Azerenerji JSC began forecasting electric power demand in 2009, and has updated these forecasts several times. In May 2013, the JICA study team conducted the "Study for Electric Power Sector in Azerbaijan" and confirmed the validity of Azerenerji JSC's forecast for 2020, utilizing an elasticity factor or "ef", defined as the electricity consumption rate to GDP growth rate, with the GDP growth rate provided by the Ministry of Industry and Energy, which is 5.3% for 2013, 7.0% for 2014, and 4.5% for 2015 and 2016.

In October 2013, FICHTNER conducted and issued a report titled "Update of the Power Sector Master Plan of Azerbaijan 2013-2025", hereinafter referred to as "Master Plan". In this Master Plan, previous electric power forecasts were reviewed and new demand forecasts of base/high/low scenarios were suggested.



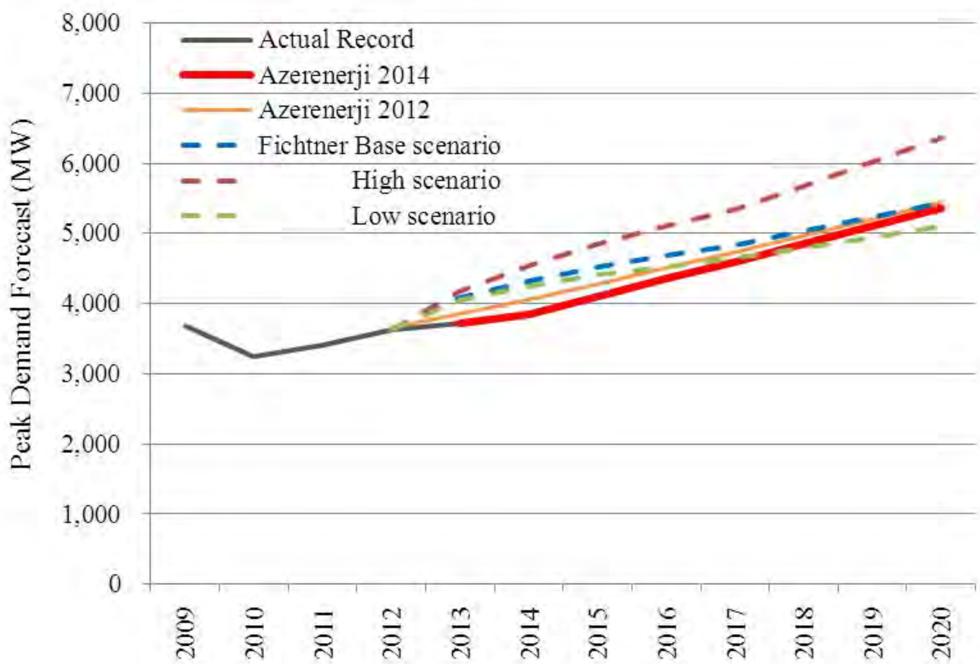
Source: JSCA

Figure 4.1-2 Electric Demand Forecast (Energy)

The latest electric power demand forecast by Azerenerji JSC with suggested demand forecasts in the Master Plan and results of JICA's study are shown in Figure 4.1-2.

Looking at the 2018-2020 period in Figure 4.1-2, under the high scenario case of the Master Plan's forecast and the ef=1.5 case (e.g. elasticity factor is 1.5) of JICA's forecast, forecasted electricity demand is almost the same. JICA's forecast ef=1.0 case is between the Master Plan's base and low scenarios. Azerenerji JSC's forecasted scenario is close to the Master Plan's base scenario and also between the high and low scenarios. Therefore, Azerenerji JSC's forecast looks viable as the base case power demand forecast for 2018-2020; a period that is quite important for the development planning of new large-scale power plants since construction takes about 5 years.

Peak demand forecasts outlined by Azerenerji JSC and the Master Plan are shown in Figure 4.1-3. In this Figure, the Azerenerji JSC 2014 forecast is almost at the same level as the Master Plan's base scenario for 2018-2020. Therefore, Azerenerji JSC's peak demand forecast during 2018-2020 seems reasonable as the base case.



Source: JSCA

Figure 4.1-3 Electric Demand Forecast (Peak)

4.2 Azerenerji JSC's Long-term Development Plan

4.2.1 Power Development Plan

Azerenerji JSC formulated its long-term power development plan (hereinafter referred to as "PDP") to meet future electric power demand. The plan up to 2020 is shown in Table 4.2-1. According to this development plan, the Yashma combined cycle power plant, located near Baku (which is the region with the highest electricity demand), plans to start operation in 2018.

Table 4.2-1 Power Development Plan of Azerenerji JSC

(MW)

Power Development Plan		2013	2014	2015	2016	2017	2018	2019	2020	Total installed until 2020
Thermal	Janub CCPP	780	-	-	-	-	-	-	-	780
	Temiz Scheher TPC	40								40
	Shimal CCPP (SGT-2)	-	400	-	-	-	-	-	-	400
	Lerik PP	-	15	-	-	-	-	-	-	15
	Boyuk-Shor PP	-	-	385	-	-	-	-	-	385
	Yashma PP	-	-	-	-	-	920	-	-	920
	Sanghachal CCPP (SOCAR)	-	-	-	-	-	-	350	-	350
	Agh Sheher TPC	-	-	-	-	-	-	-	300	300
Hydro	Small HPPs	6	38	-	50	-	-	100	-	194
Alternative Power Plants (wind, solar)		5	45	50	50	-	-	50	-	200
Total		831	498	435	100	-	920	500	300	3,584

Source: JSCA

4.2.2 Power Plant Retirement Plan

Retirement of aging thermal power plants is also considered under Azerenerji JSC's long-term power development plan as shown in Table 4.2-2. Shirvan thermal power station, which is the oldest generation plant, is set to be retired in 2014, after the Janub Combined Cycle Power Plant comes online. The Azerbaijan Thermal Power Plant is an old power plant and two units are scheduled to retire in 2018, which is the year of installation of the new large-scale thermal power plant in Yashma.

Table 4.2-2 Azerenerji JSC's Power Plant Retirement Plan Outlook

(MW)

Retirement Plan		2013	2014	2015	2016	2017	2018	2019	2020	Total retired until 2020	Remained at 2020
Thermal	Shirvan TPP	-	▲ 900	-	-	-	-	-	-	▲ 900	0
	Azerbaijan TPP	-	-	-	-	-	▲ 600	-	▲ 600	▲ 1,200	1,200
Hydro	-	-	-	-	-	-	-	-	-	0	0
Alternative Power Plants (wind, solar)		-	-	-	-	-	-	-	-	0	0
Total		-	▲ 900	-	-	-	▲ 600	-	▲ 600	▲ 2,100	-

Source: JSCA

4.2.3 Supply Demand Balance of the Development Plan

The supply demand balance until 2020 is shown in Table 4.2-3.

Electric power export is considered in this plan. Prior to 2006, power imports by Azerenerji JSC exceeded exports. Azerenerji JSC had been trying to cut imports due to security reasons, and the import/export balance changed to an export surplus from 2007 onwards. An inter-connection in the power trade to Turkey via Georgia was made from 2010 and Turkey is the largest power import country from Azerbaijan. Therefore, Azerenerji JSC can export surplus electricity to the power market. Power import and export performance of the neighboring countries during 2010 to 2013 is shown in Table 4.2-4.

Table 4.2-3 Supply Demand Balance of Azerbaijan's Power System Plan

	Item		unit	2013	2014	2015	2016	2017	2018	2019	2020
I	Peak demand		MW	3,720	3,850	4,100	4,350	4,600	4,850	5,100	5,360
	Increase over the previous year		%	2.6	3.5	6.5	6.1	5.7	5.4	5.2	5.1
II	Installed capacity - total:		MW	6,895	6,493	6,928	7,028	7,028	7,348	7,848	7,548
	THERMAL	Existing Thermal PP		5,101	5,921	5,436	5,821	5,821	5,821	6,141	6,491
		Retirement TPP			▲ 900				▲ 600		▲ 600
		Newly installed TPP		820	415	385			920	350	300
		Installed capacity - TPP Total:	MW	5,921	5,436	5,821	5,821	5,821	6,141	6,491	6,191
	HYDRO	Existing HydroPP		963	969	1,007	1,007	1,057	1,057	1,057	1,157
		Newly installed HPPs		6	38		50			100	
		Installed capacity - HPP Total:	MW	969	1,007	1,007	1,057	1,057	1,057	1,157	1,157
	Renewable Power Plants (wind, solar) Total		MW	5	50	100	150	150	150	200	200
III	Available Capacity			5,065	5,583	5,958	6,328	6,328	6,608	7,218	6,948
IV	Restrictions		MW	▲ 1,830	▲ 910	▲ 970	▲ 700	▲ 700	▲ 740	▲ 630	▲ 600
V	Import-export balance		MW	▲ 180	▲ 380	▲ 380	▲ 380	▲ 380	▲ 380	▲ 380	▲ 380
VI	Demand / Supply Balance Surplus (+) / Deficit (-)		MW	1,165	1,353	1,478	1,598	1,348	1,378	1,738	1,208
VII	Reserve margin		%	31.3%	35.1%	36.0%	36.7%	29.3%	28.4%	34.1%	22.5%

Source: JSCA

Table 4.2-4 Export and Import of Electric Power for Neighboring Countries (2010 -2014)

(GWh)

	Country name	2010	2011	2012	2013
Export	Russia	202.6	391.6	240.8	128.6
	Iran	25.7	0.7	2.8	4.9
	Turkey	156.1	329.9	277.4	276.7
	Georgia	10.3	23.4	97.5	23.6
	Total	394.6	745.6	618.5	433.7
Import	Russia	17.8	44.2	55.8	57.4
	Iran	0.0	0.0	0.1	0.4
	Turkey	0.4	19.4	12.9	0.2
	Georgia	14.3	5.9	11.8	6.6
	Total	32.5	69.6	80.6	64.7
	Net Trade Balance	362.1	676.0	538.0	369.1

Source: JSCA

The target reserve margin rate (RMR) was reviewed by the JICA study team in 2013 as follows.

2012-2016: about 30%
2018-2022: about 25%

In the development plan, the RMR in 2020 is 22.5%, lower than the target RMR of 25%. The RMR of the other years appear acceptable in Azerenerji JSC's plan, and therefore this plan seems preferable from the view point of the supply/demand balance.

Installation of the Yashma CCPP, which has a capacity of 920MW, is planned to be completed in 2018. Under a scenario whereby development of the Yashma project is shifted to 2019, the reserve margin for 2018 is 21.8%. This is lower than the target RMR of 25%, even when 600MW is not retired but shifted to 2019. Therefore, development of the Yashma thermal power plant in 2018 is important in maintaining a stable power supply.

The improvement of efficiency through power-saving and energy conservation measures at the demand side is expected to be considered in the future. Ensuring power supply is a priority at present and concrete action is not taken under the situation that gas or oil can be produced abundantly.
Therefore, it is expected that the awareness for the efficiency improvement in the demand side will increase gradually along with power demand expansion in the future.

4.2.4 Transmission Lines and Substations Plan

Transmission lines and substation plans for the Yashma CCPP Project are shown in Tables 4.2-5 and 4.2-6. All projects for the Yashma CCPP are set to be completed by 2018. As of this study, detailed schedules of each plan are under consideration.

Table 4.2-5 Planned New Transmission Lines for Yashma CCPP

Voltage (kV)	Section of Transmission Line	No. of Circuit	Length (km)	Planned Completion Year
330	Yashma E/S - Yashma S/S	1	8.4	2018
	Yashma E/S - Sulu Tepe S/S	1	37.4	2018
220	Yashma E/S - Yashma S/S & Sanaya Qovsagi S/S	2	4.6	2018
	Yashma E/S - Absheron S/S & Boyuk Sor S/S	2	23.5	2018
	Yashma E/S - Sumgayit S/S	2	17.3	2018

Source: JSCA
S/S: Substation
E/S: Power Station

Table 4.2-6 Planned New Substations for Yashma CCPP

Voltage (kV)	Name of Substation	Capacity (MVA)	Planned Completion Year
330	Yashma S/S Extension	1x200,2x240	2018
330	Sulu Tepe S/S	1x400, 2x250	2018
220	Sumgayit S/S	2x125	2018

Source: JSCA
S/S: Substation

4.2.5 Route Survey

(1) General

The route survey for the new 330kV and 220kV transmission lines in the Yashma area for the new Gas Combined Power Plant (Yashma CCPP) was carried out to identify places to be avoided along the route for the new transmission lines. The route survey areas are shown in Figure 4.2-1.

Places to be avoided are as follows:

Residential areas, churchyards, national parks, heritage sites, protected areas, forests, cemeteries, rivers, lakes, railways, and highways, etc.

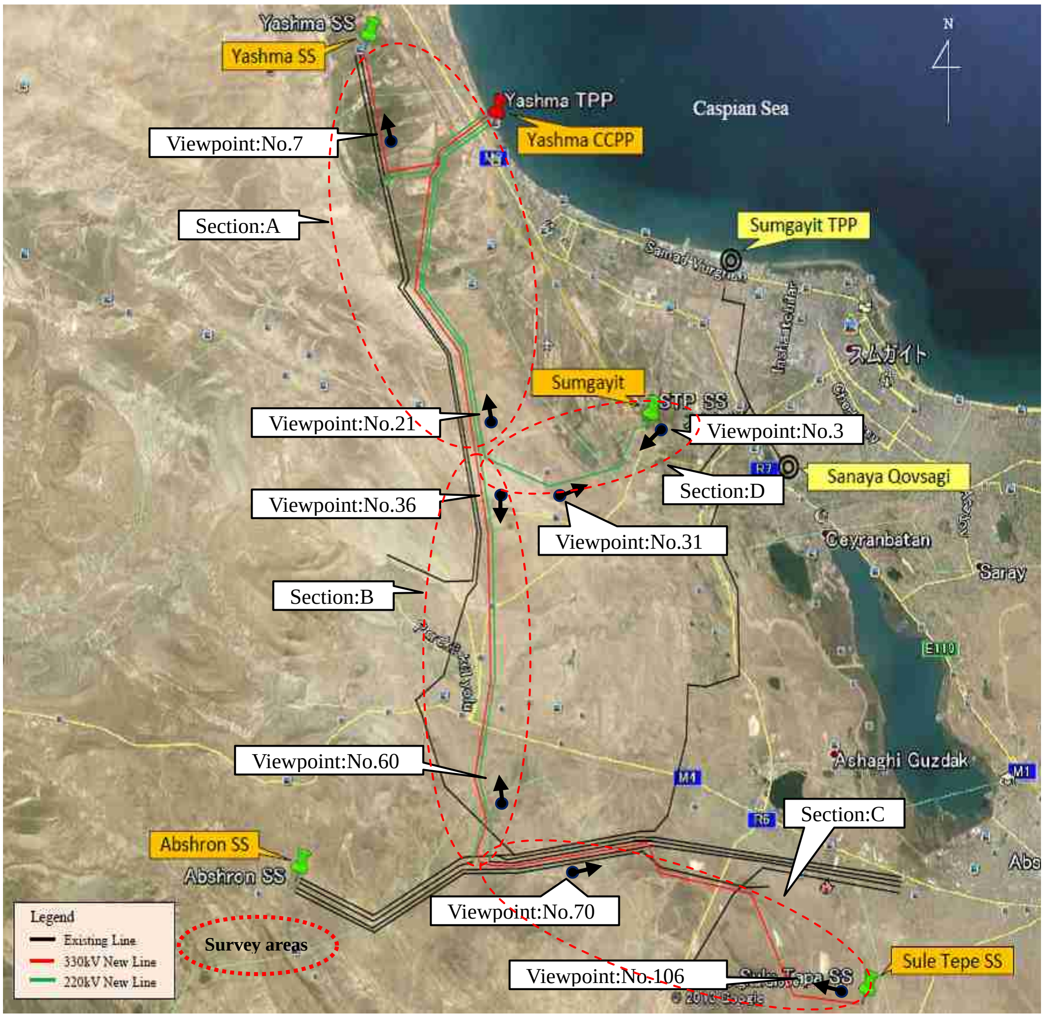


Figure 4.2-1 Route Survey Areas

(2) Results of the Route Survey

Outline results of the Route Survey are shown below:

1) Section A

There are no places that need to be avoided. Almost all the areas surrounding the transmission lines are wastelands. Typical surrounding environment is shown in Figure 4.2-2.

(Refer to Fig.4.2-1, Viewpoint:No.7)

(Refer to Fig.4.2-1, Viewpoint:No.21)

Figure 4.2-2 Typical Situation of Section A

2) Section B

There are no places that need to be avoided. Almost all the areas surrounding the transmission lines are wastelands.

Typical surrounding environment is shown in Figure 4.2-3.

(Refer to Fig.4.2-1, Viewpoint:No.36)

(Refer to Fig.4.2-1, Viewpoint:No.60)

Figure 4.2-3 Typical Situation of Section B

3) Section C

There are no places that need to be avoided. Almost all the areas surrounding the transmission lines are wastelands.

Typical surrounding environment is shown in Figure 4.2-4.

(Refer to Fig.4.2-1, Viewpoint:No.70)

(Refer to Fig.4.2-1, Viewpoint:No.106)

Figure 4.2-4 Typical Situation of Section C

4) Section D

There are no places that need to be avoided. Almost all the areas surrounding the transmission lines are wastelands.

Typical surrounding environment is shown in Figure 4.2-5.

(Refer to Fig.4.2-1, Viewpoint:No.31)

(Refer to Fig.4.2-1, Viewpoint:No.3)

Figure 4.2-5 Typical Situation of Section D

Chapter 5

Survey of Power Plant Site

Chapter 5 Survey of Power Plant Site

5.1 Site Situation

5.1.1 General

Azerbaijan is characterized by a typical continental climate consisting of a hot summer, comparatively cold winter, a temperature difference between daytime and night time, and dry weather with little rain.

The planned project site is the Yashma, Sumgayit city in Azerbaijan, approximately 45 km northwest of Baku, the capital of Azerbaijan, and approx. 22 km northwest of the Sumgayit combined cycle power plant (525 MW, 2-1 configuration). Location of the Yashma Project site is shown in an aerial photograph in Figure 5.1-1.

Source: Google earth

Figure 5.1-1 Location of the Yashma Project Site

Figure 5.1-2 shows the area of the Yashma Project Site from an aerial photograph. The front of the site is facing the Caspian Sea. There is a national highway to the rear of the site (width approx. 350m and a length of 2,100m (71.5ha)). There is a 110 kV transmission line parallel to the national highway (See Figure 5.1-3). JSCA will relocate a 110kV transmission line to the outside of the site within site preparatory work. There are no residences on the site and no rivers pass through the territory. The Yashma Gas Combined Cycle Power Plant is projected to require an area of approximately 30 ha in the center of site area. JSCA plans to prepare an employee’s residential area on left side of power plant, and a plantation & park area on right side.

Source: Google earth

Figure 5.1-2 Area of Yashma Project Site

Source: Study team

Figure 5.1-3 Photograph of Yashma Project Site

5.1.2 Site Selection

Site arrangement for the power plant requires selecting a site as a first step. Generally speaking, the site must be carefully chosen considering environmental factors, socio-economic factors, licensing factors, technical factors and plant life time costs, etc. Figure 1.2-1 in Chapter 1 and Figure 5.1-1 & 2 show the Yashma project site. Figure 5.1-4 shows the Gobustan project site.

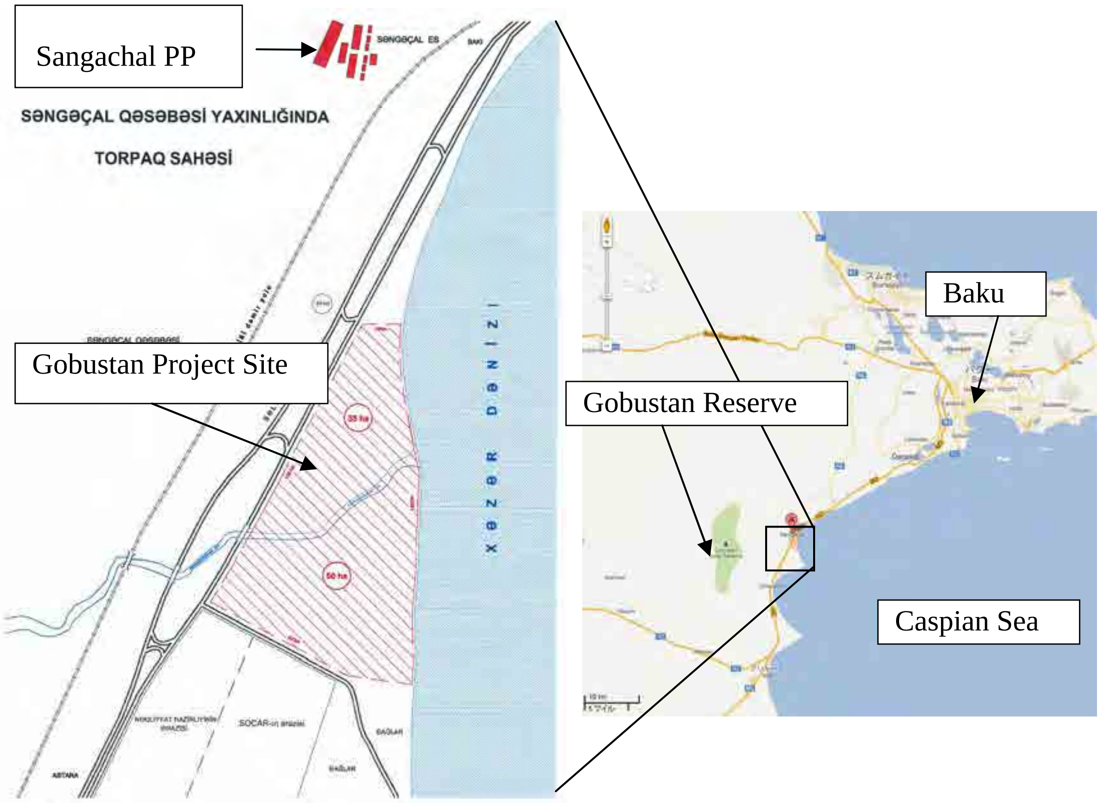


Figure 5.1-4 Gobustan Project Site

Table 5.1-1 illustrates the comparison between candidate sites Yashma and Gobustan. Comparative items are general site conditions, water sources, electricity network, fuel supply, land acquisition and environmental aspect.

Table 5.1-1 Comparative Table of Construction Sites

Item	Candidate site	
Name	Yashma	Gobustan
1.General		
(1) Site	Yashma site is located approximately 45 km northwest (NW) of Baku, and approx. 22 km NW of the Sumgayit power plant	Gobustan site is located in Sangachal settlement approx. 40 km southwest (SW) of Baku.
Evaluation	Acceptable (Close to high electricity demand area)	Acceptable (Close to high electricity demand area)
(2) Area	71.5 ha (width 300m x length 2,400)	83 ha (width 880m x length 1,300)

Item	Candidate site	
Name	Yashma	Gobustan
Evaluation	Acceptable (Area is sufficient for 900-950MW gas-fired combined cycle power plant and related facilities including switchgear)	Acceptable (Area is Sufficient for 900-950MW gas-fired combined cycle power plant and related facilities including switchgear)
(3) Existing site conditions	There is a 110 kV transmission line parallel to a national highway.	Unclear
Evaluation	The 110kV power transmission steel tower must be relocated.	Site survey will be required.
(4) Access	A new access road must be constructed.	A new access road must be constructed.
Evaluation	Access road will be required.	Access road will be required.
(5) Security	Security fencing and a main site access gate will be installed and the site access gate will be secured.	Security fencing and a main site access gate will be installed and the site access gate will be secured.
Evaluation	Security fencing and a main site access gate will be required in Bidding document.	Security fencing and a main site access gate will be required in Bidding document.
2.Water sources		
(1) Raw water	Desalination plant will be installed (Alternative water source is considered for potable water).	Desalination plant will be installed (Alternative water source is considered for potable water).
Evaluation	Desalination plant will be required in Bidding document.	Desalination plant will be required in Bidding document.
(2) Cooling water	Caspian sea is available.	Caspian sea is available.
Evaluation	Water intake system will be required in Bidding document.	Water intake system will be required in Bidding document.
3.Network		
(1) Transmission line	Transmission Line route is fixed by JSCA.	Transmission Line route is not yet fixed by JSCA.
Evaluation	Favorable	Transmission line route will be required.

Item	Candidate site	
Name	Yashma	Gobustan
(2) Substation	Basic design is fixed by JSCA.	Basic design is not yet fixed by JSCA.
Evaluation	Favorable	Basic design will be required.
4.Fuel		
(1) Fuel gas supply	There is potential source for fuel gas from Khizi site.	Unclear
Evaluation	Favorable	Fuel gas supply plan will be required.
5.Land Acquisition		
(1) Acquisition	Under process	Unplanned
Evaluation	Favorable	Acquisition will be required.
6.Environmental aspect		
(1) Environmental Social Consideration	Since Yashma site is located in a nonresidential area, relocation of local people will not be necessary. The site is not located in farmland but in wasteland close to the shore. The site is not located in forests or wetlands.	Since Gobstan site is in non residential area, relocation of local people will not be necessary. The site is not located in farmland but in wasteland close to the shore. The site is not located in forests or wetlands.
Evaluation	Favorable	Favorable
(2) EIA report	JSCA and study team will prepare by June 2014. Stake holder meeting will be held twice (2).	Unplanned
Evaluation	Favorable	EIA report will be required.
7.Over all Evaluation	Applicable	Further arrangements of the power plant on the site will be required - such as general site conditions, electricity network, fuel supply, land acquisition and environmental aspect.

The above table suggests that Yashma is superior to Gobustan as a candidate construction site for a new power plant.

Thus, Yashma is recommended as a construction site for a new power plant.

5.2 Field Survey

5.2.1 Summary

Yashma Site is located 43 km to the north of Baku City, and adjacent to the northern part of Z.Tagiyev settlement, on the shores of the Caspian Sea.

To understand the current state of Yashma site, the following site investigations were conducted.

1. Topographic Survey（71.5ha）
2. Bathymetric Survey（1,500×3,000ｍ）
3. Soil Investigation (Onshore Boring)（Six bores）
4. Soil Investigation (Offshore Boring)（Three bores）

The range of this survey is as shown in Figure 5.2-1.

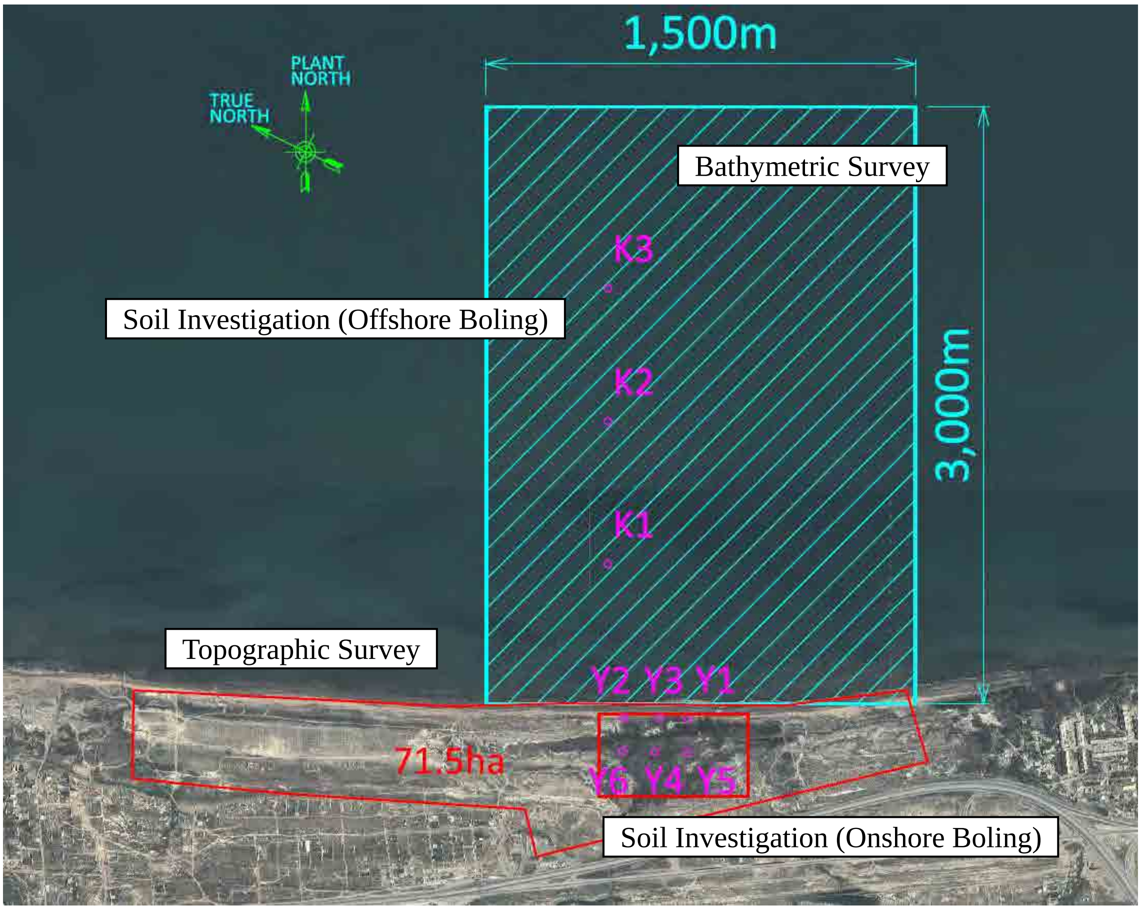


Figure 5.2-1 Field Survey Range

5.2.2 Topographic Survey

(1) Outline

Yashma site is located 43 km to the north of Baku City, adjacent to the northern part of the Z.Tagiyev settlement, on the shores of the Caspian Sea. There are highways and railway lines near the site, connecting the Azerbaijan Republic with the Russian Federation. The survey area is 71.5 ha. A topographic and geodetic survey was carried out from 1st July 2013 to 10th December 2013. The range of this survey is as shown in Figure 5.2-2.

Figure 5.2-2 The Range of Topographic Survey

(2) Result of the Topographic Survey

The terrain is mainly flat, in some places hilly or with small forms of topography.

Also pits, earth banks and minor water streams exist.

Contour lines on the maps were drawn through all topographical facilities, except for topographical forms of artificial origin.

The following survey results may be mentioned:

- The area consists of flat plains (95%) and hills (5%).
- Topsoil consists mainly of shrubs and marsh grass.
- There are no cemeteries, national parks or protected zones in this area.
- Main irregularities (crossings) are as follows: 110 kV PTL (1 Nos.)

The power-transmission line (110 kV PTL) crosses the site.

1) Topographical map

Figure 5.2-3 shows the topographical map.

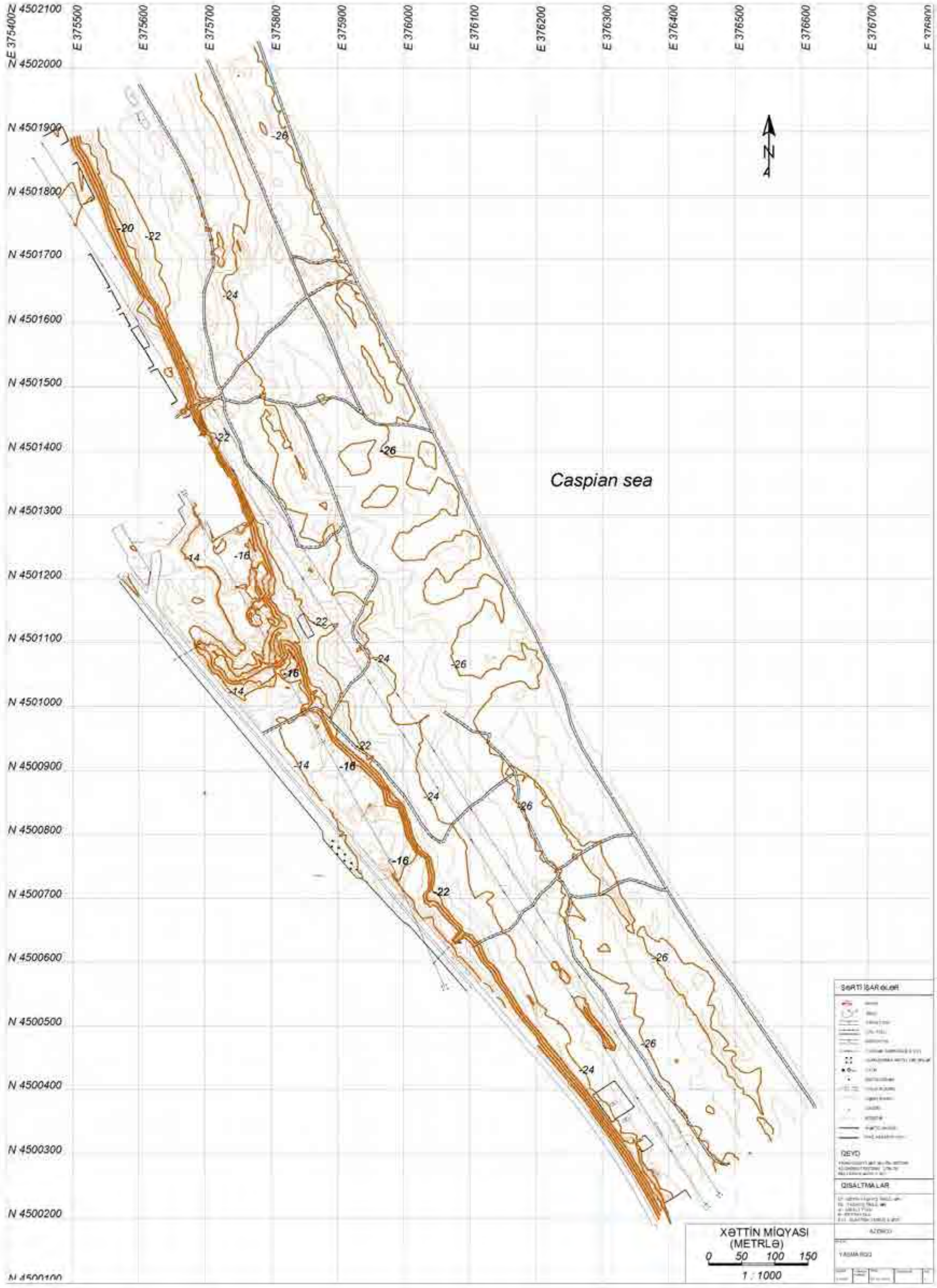


Figure 5.2-3 Plan

2) Cross section

Figure 5.2-4 shows the Key Plan. Figure 5.2-5-Figure 5.2-7 shows the cross section. The site will built on a plain extending 300m-400m from the coast. On the tip of the plain is a cliff, and there is an approximately 10m difference in elevation. A national road runs through the head of the cliff.

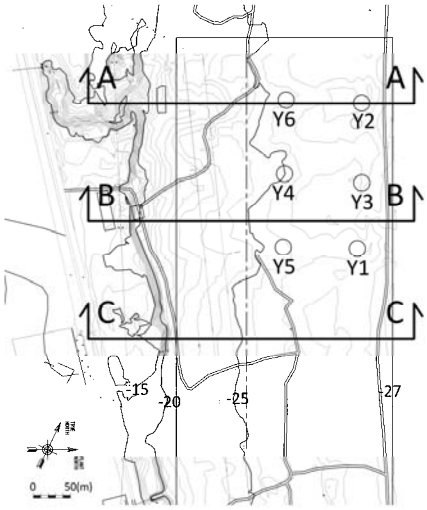


Figure 5.2-4 Key Plan

Figure 5.2-5 A-A Cross Section

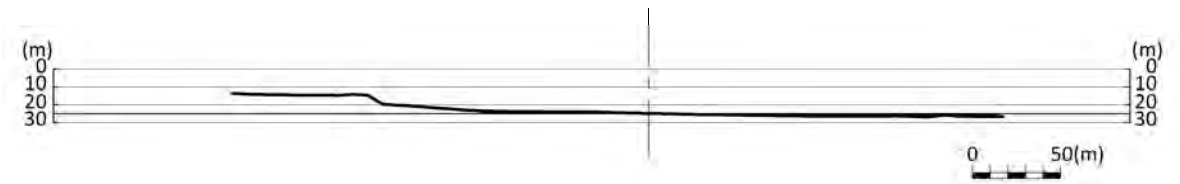


Figure 5.2-6 B-B Cross Section

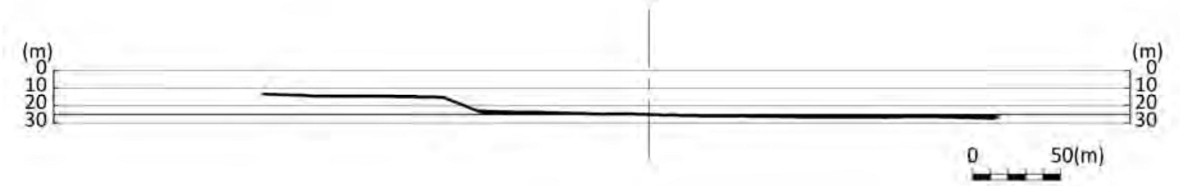


Figure 5.2-7 C-C Cross Section

5.2.3 Bathymetric Survey

(1) Outline

When a basic examination was executed, the sounding was executed to understand the depth situation in a front sea area on the site. Bathymetric surveys were carried out from 4th January 2014 to 27th April 2014 during the calm weather conditions on the sea.

Figure5.2-8 Measured Range

(2) Results of the Bathymetric Survey

The sounding was done in the sea area in front of the site (coast direction 1500m × cross shore 3000m). The traverse line interval was assumed to be 10m. Figure 5.2-9 shows the isobaths diagram based on the sounding results.

The sounding of the lake bed is performed to the following accuracy:

- 0.1 m at depths to 10 m
- 0.2 m at depths from 10 m to 20 m

Bathymetric measuring (tack) of Caspian Sea (part, where Yashma TPP to be constructed) was carried out every 50 m.

For design works and for getting a detailed plan, points were picked every 10 m.

The number of necessary points was determined depending on the sea configuration and size.

Bathymetric survey works were carried out from 4th January 2014 to 27th April 2014 during calm sea weather conditions.

Water level on the Caspian Sea shore is 27.21 m. Width of bathymetric survey (along the shore) is above 2000 m; the length (perpendicular to coast) is above 3000 m. Scope of bathymetric survey is ≈ 700 ha.

Depth increase dynamics moving away from the coast are shown in the Table 5.2-1.

3000 m away from the coast the depth is 8.80 m. 7th m of the sea depth is located at a distance of 1130 m from the coast.

Table 5.2-1 Depth Increase Dynamics Moving Away from the Coast

Coast distance, m	Height, m	Average depth, m
0	-27.21	0
10	-27.25	0.04
50	-27.48	0.27
100	-27.73	0.52
200	-28.26	1.05
400	-29.39	2.18
650	-31.51	4.30
1000	-33.65	6.44
1500	-34.68	7.47
2000	-35.17	7.96
2500	-35.54	8.33
3000	-36.01	8.80

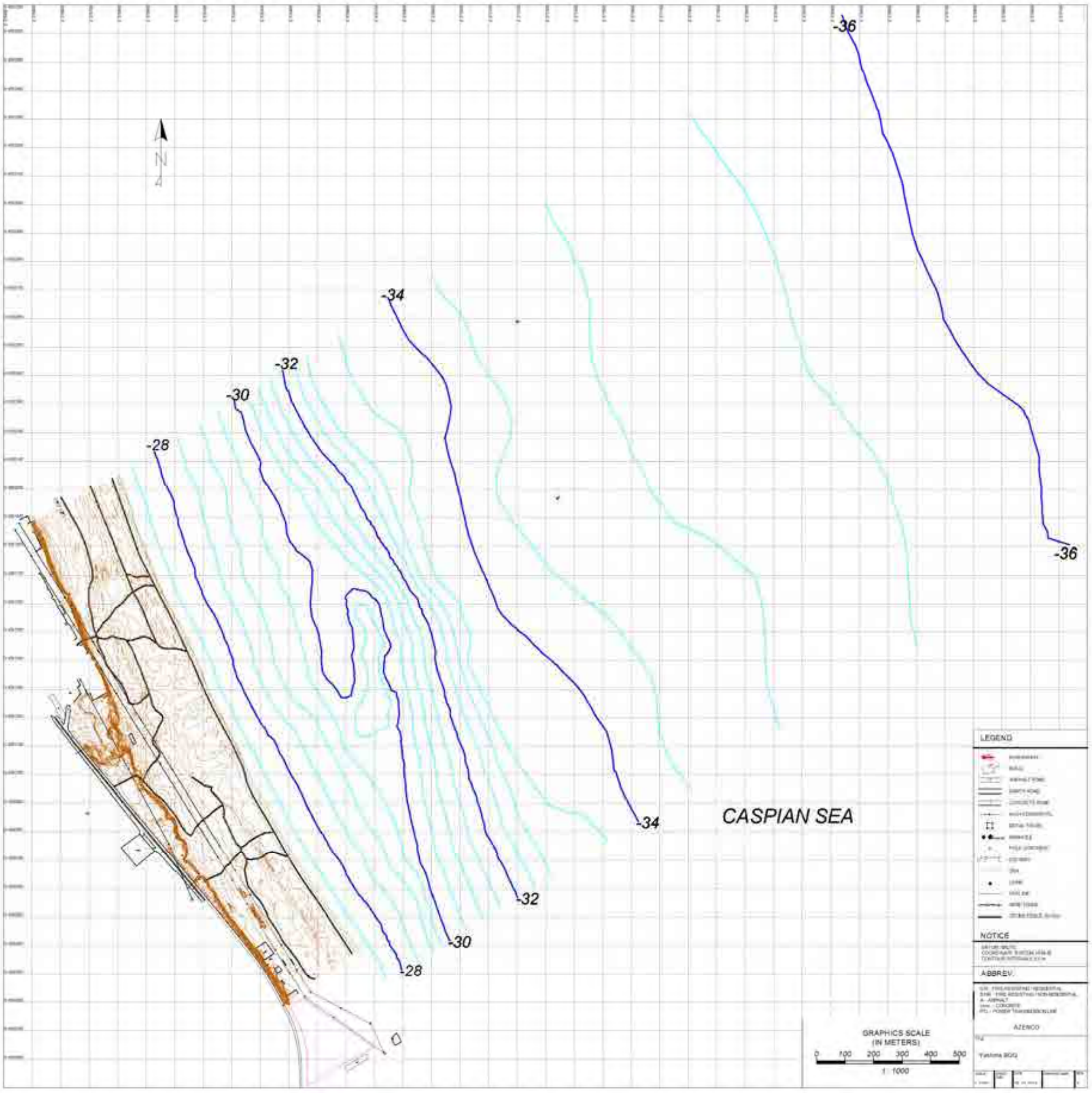


Figure5.2-9 Bathymetric Map

5.2.4 Soil Investigation (Onshore Boring)

(1) Outline

On the construction site field investigations started on 22nd December 2013 and were completed on 30th March.

- Engineering-geological investigation works consist of the followings:
- Visual check of the area and surroundings related to geological engineering, geological and hydrogeological conditions;
- Mechanical-core boring & sampling;
- Laboratory studies;
- Standard penetration test (SPT);
- Office studies.

Figure 5.2-10 Measure Range

Table 5.2-2 Bore Position

№	Thing	Borehole №	Depth of borehole m	Axis		Absolute height and m.(H)
				X	Y	
1	Intake	1	50	4501059.316	376178.53	-26.366
2	Pump station	2	50	4501239.780	376097.349	-26.206
3	The main factory building	3	60	4501142.294	376145.011	-25.587
		4	60	4501107.346	376045.571	-25.673
4	Distribution unit and coal storage	5	30	4501017.128	376087.381	-25.793
		6	30	4501198.766	376003.602	-25.600

1) Brief physiographic conditions of the investigated area

Survey area is orographically situated in the north-west of the Absheron peninsula, in the north part of H.Z.Tagiev settlement, to the right side of Baku-Guba highway – along the seashore. Administratively, it is included in H.Z.Tagiev settlement of Sumgayit city. Geomorphologically the area is situated on a plain, and beach lowland. The seashore is about 40-150 m away from the constructions of the main project and approximately 350 m away from Baku-Guba highway. Most of the surveyed area is levelled plain, the seaboard and its surroundings are covered with sea sand and saline type plants. Absolute elevation of ground surface is minus 25.5-26,5m. Sea line elevation is minus 27.29 m (March-2014). Highway side elevation is minus12-13m. It is slightly inclined to the north-east (in the direction of the sea).

Figure 5.2-11 Picture 1 General View of Investigated Area

2) Climate

The climate of the area is semi-desert and dry desert type. This climate type is characterized with a mild winter, and a dry and warm summer.

Main climate element (air temperature, humidity, rainfall, wind, etc.) characteristics on perennial observation period are given according to the Sumgayit meteorological station.

Air temperature; mean monthly and mean annual temperatures (^{0}C) are given in the Table 5.2-3.

Table 5.2-3 Air Temperature; Mean Monthly and Mean Annual Temperatures

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
4,0	3,9	6,3	11,7	17,5	22,4	25,5	25,4	21,6	15,8	10,9	6,7	14,3

Table 5.2-4 contains absolute maximum and minimum temperatures (^{0}C).

Table 5.2-4 Contains Absolute Maximum and Minimum Temperatures (^{0}C)

	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Absolute maximum	22	26	32	33	36	41	42	42	37	37	30	28	42
Absolute minimum	-15	-14	-6	-2	3	6	12	12	8	-1	-8	-10	-15

According to Sumgayit weather station data, during a year, the number of days with a mean daily temperature of 0^0C and below is 8 (November-March), and number of days with air temperature of above 20^0C is 124 (March-December). Initial frost during the night and morning hours is recorded on average on the 11th of December and the last frosts are observed on the 20th of March. The frost-free season average duration is 265 days.

Humidity; mean monthly and mean annual relative humidity values are given in Table 5.2-5.

Table 5.2-5 Relative Moisture (%)

1	2	3	4	5	6	7	8	9	10	11	12	Annual
80	80	79	74	68	65	66	66	70	76	79	78	73

Precipitation; Table 5.2-6 shows distribution of rainfall by months, precipitation in the cold and hot periods and annual precipitation, mm.

Table 5.2-6 Distribution of Rainfall by Months

1	2	3	4	5	6	7	8	9	10	11	12	11 - 3	4 - 10	Annual
24.7	21.2	19.7	22.7	18.2	9.7	2.9	7.7	18.0	26.9	27.8	24.9	118.3	106.1	224.4

Wind; mean monthly and annual wind speeds (m/sec) are given in Table 5.2-7.

Table 5.2-7 Monthly and Annual Wind Speeds (m/sec)

1	2	3	4	5	6	7	8	9	10	11	12	Annual
7.2	7.2	7.7	7.0	6.3	6.4	7.0	6.9	6.9	7.2	6.8	6.8	7.0

Table 5.2-8 presents average number of days with strong winds (≥15 m/sec).

Table 5.2-8 Average Number of Days with Strong Winds (≥15 m/sec)

1	2	3	4	5	6	7	8	9	10	11	12	Annual
13.2	13.9	14.6	12.9	9.8	9.1	10.4	9.5	10.7	11.6	10.5	13.0	13.9

According to the Sumgayit weather station, prevailing wind directions are north, south and north-west.
Frequency of wind directions and calm during a year (%) is given in Table 5.2-9.

Table 5.2-9 Frequency of Wind Directions and Calm during A Year (%)

N	NE	E	SE	S	SW	W	NW	Calm
28	8	4	5	23	7	3	22	6

(2) Result of Soil investigation

1. Geological-lithologic and geological-engineering conditions of the investigated area may be considered as relatively middle complicated, however, it is not contradictory for the designed facilities construction.
2. Ground surface of the investigated area is mainly plain, absolute elevations vary from minus 25.0,0 m to minus 26 m and the total slope is directed to the north-east.
3. Geological formation basis of the area is formed from Lower Pliocene Productive layer deposits and lithologically consists of thick clay soils. From the ground surface

it is covered with Contemporary Quaternary, New Khazar (mQıv) aged sands and has a very small thickness (0.5-1.5 m).

4. Tectonically, the area is included into Central Absheron zone, Gurgachidagh anticlinal wing of Altiaghaj-Gurgachidagh anticlinorium. Tectonic faults are rarely recorded in the area itself.

5. Geomorphologically, the area concerns to flat, seaside beach plain.

6. Ground water plane has been observed in all boreholes in the area and their average level is 0.6 m.

7. Water mineralization is high - 12 g/l. By salt content, they are chloride-natrium and chloride-natrium-sulphate. By sulphate quantity and mineralization degree, they are aggressive against Portland-cement and normal dense concretes.

8. According chemical analysis of aqueous extracts, quick and medium water-soluble salts amount is 6.7-19.6%. Salt content is mainly sulphate-natrium, and sometimes sulphate-chloride-natrium. According to GOST 25100-95, the soils are considered as surplus saline. Thus, by chemical composition, the soils are aggressive against normal dense Portland-cement. In the case of complete solution of salts in water, it might be aggressive also against sulphate-resistant cement.

9. High mineralization of waters, presence of salt in soils make the soil-water environment highly aggressive against sulphate-resistant cement. Taking this into account, measures should be taken for protection of foundations against aggressive features.

10. Soils, forming the area's section, are divided into 3 geological-engineering elements (GEE) according to lithologic types, physico-mechanical characteristics and existing specifications (GOST 20522-96):

1) G.E.E.-1. mQıv. Sand soil.
2) G.E.E.-2. (N_2^1pr). Clay soil, hard consistency, eroded.
3) G.E.E.-3. (N_2^1pr). Clay soil, hard consistency.

11. From design unit side, installation of structures is advisable after making decision on type and depth of foundation, specifying of bearing layer top and design parameters.

1) Geological profile

Figure 5.2-13-Figure 5.2-17 shows a geological section.

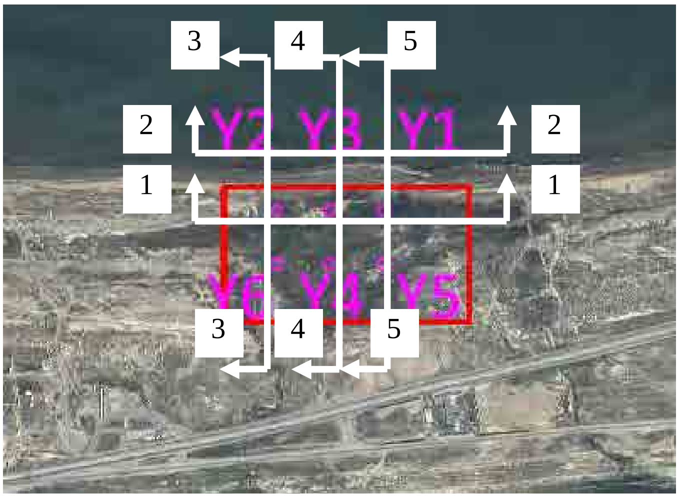


Figure 5.2-12 Key Plan

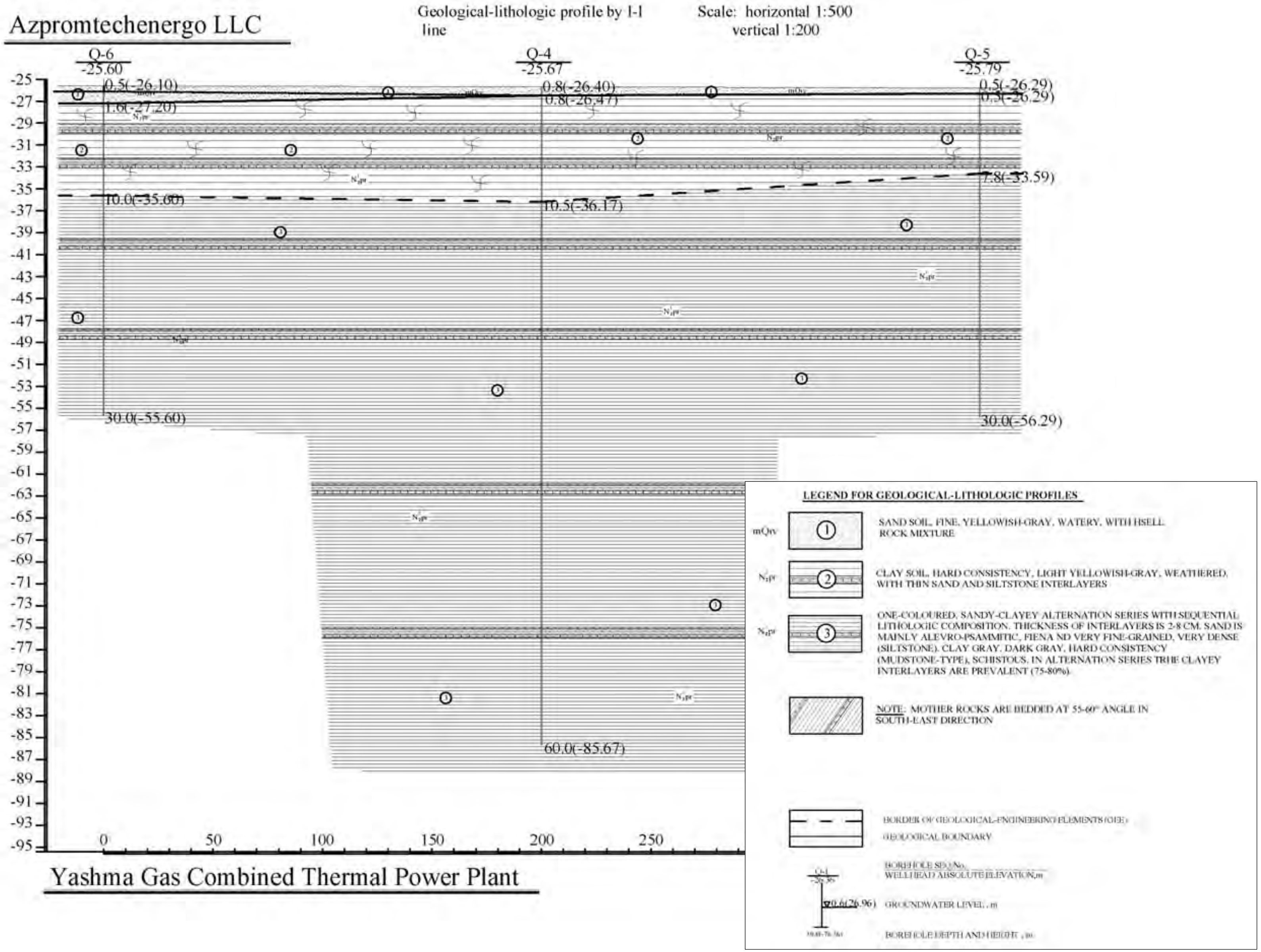


Figure 5.2-13 1-1 Cross Section

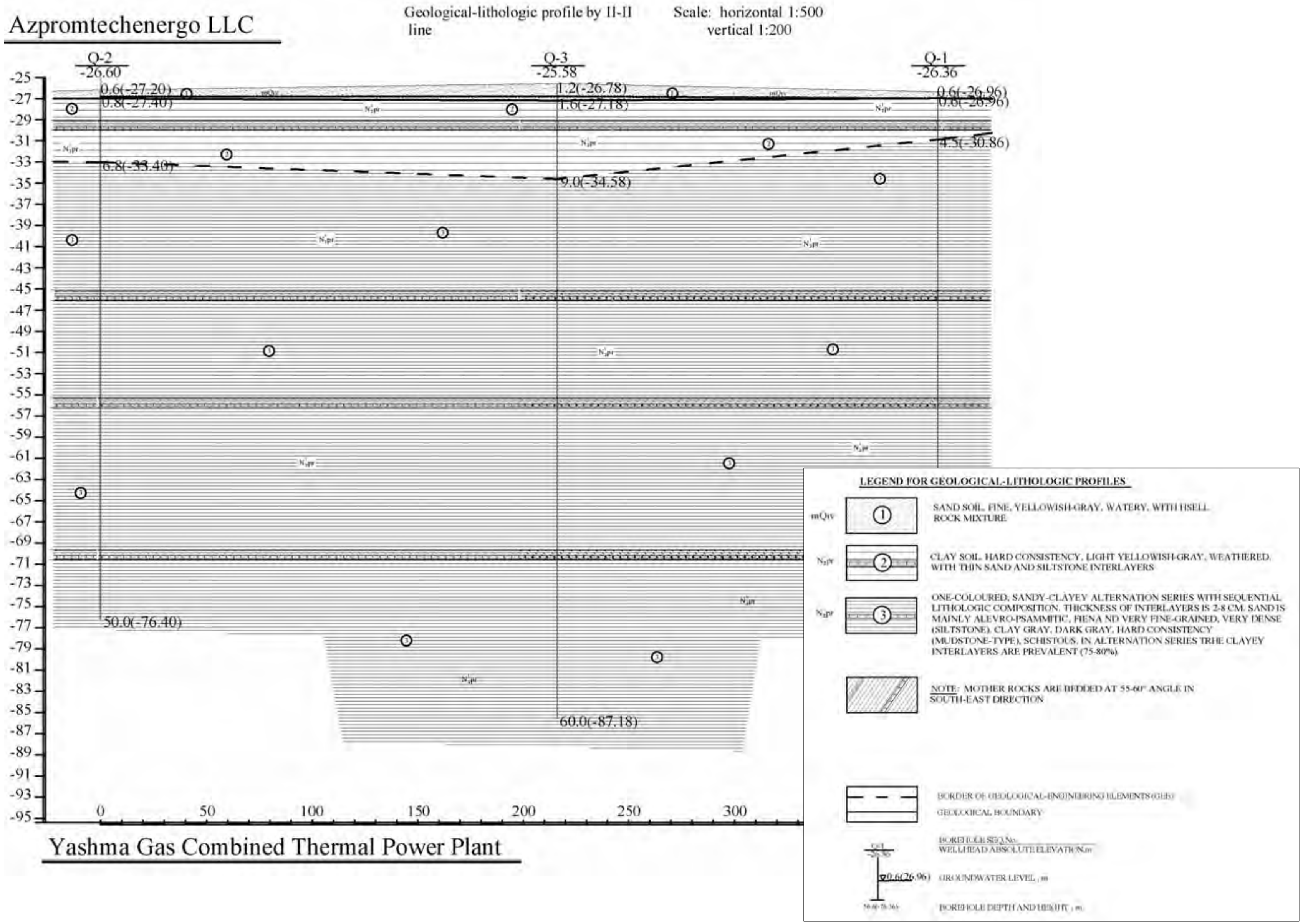


Figure 5.2-14 2-2 Cross Section

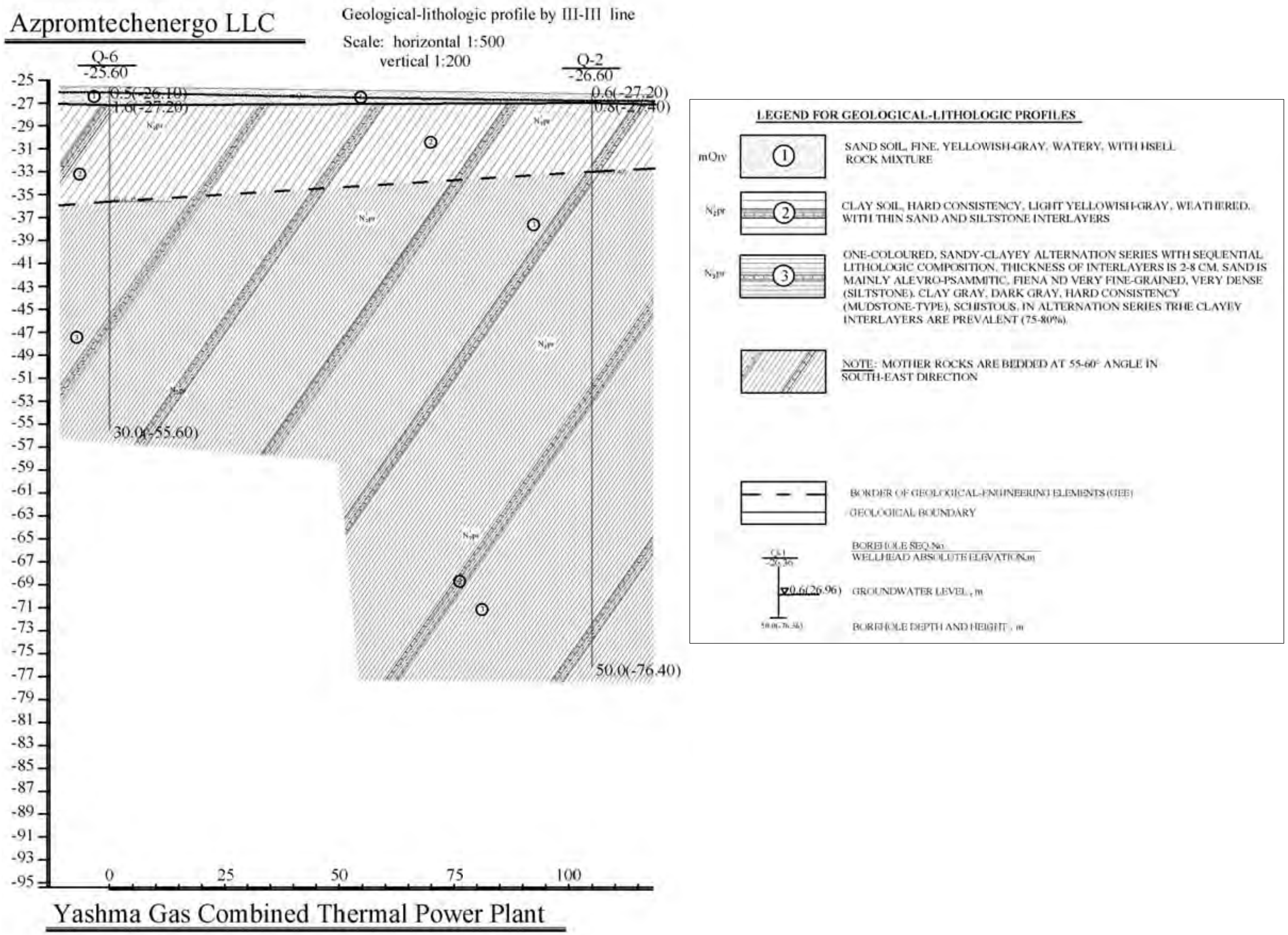


Figure 5.2-15 3-3 Cross Section

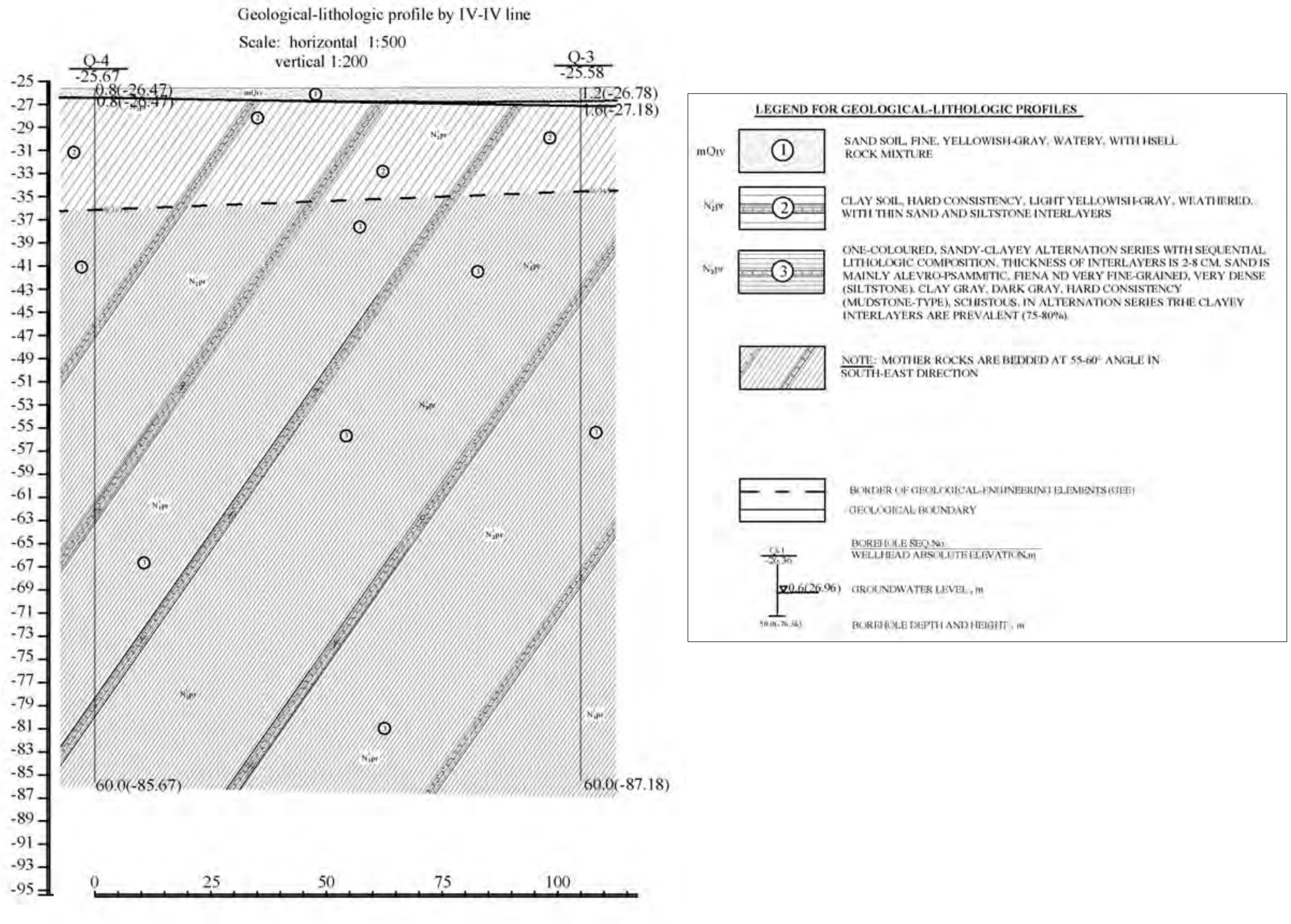


Figure 5.2-16 4-4 Cross Section

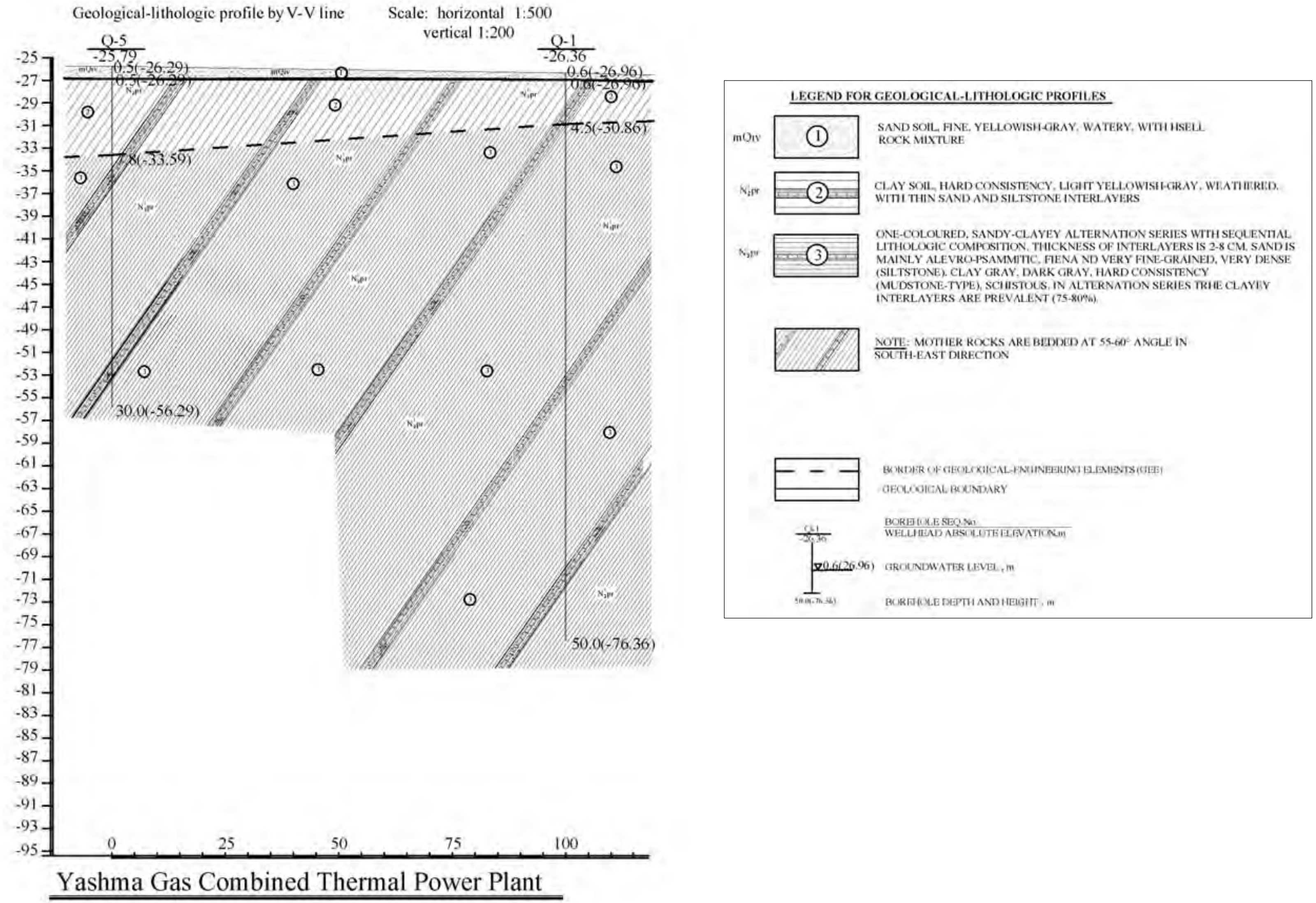


Figure 5.2-17 5-5 Cross Section

2) Geologic columnar section

Figure 5.2-18-Figure 5.2-23 shows the geologic columnar section.

BOREHOLE No1, COLUMN AND THE RESULTS OF DYNAMIC PROBING TEST

WELLHEAD ABSOLUTE ELEVATION: -26.366 m

Koordinatlar: X: 4501059.316 Y: 376178.53

STARTED: 22.12.2013

TYPE OF DRILLING: CORE - DRILLING

COMPLETED: 04.01.2014

Geological index: N_2^2pr

СПТ DEPTH, m	SPT RESULTS NUMBER OF BLOWS 15cm	15cm	15cm	№(H)30,cm
1.0	7	15	20	35
2.0	11	21	28	49
3.0	6	13	17	30
4.0	15	21	29	50
5.0	18	50	50/5	>100
6.0	27	38	50/3	>100
7.0	20	50/2	-	>100
8.0	19	34	40	74
9.0	22	31	37	67
10.0	31	50/4	-	>100
11.0	18	40	50	90
12.0	29	50/3	-	>100
13.0	36	50	50/4	>100
14.0	18	44	50/6	>100
15.0	18	29	39	68
16.0	20	30	34	64
17.0	21	31	38	69
18.0	20	23	31	54
19.0	38	50/3	-	>100
20.0	32	50/4	-	>100
21.0	28	50/3	-	>100
22.0	50	50/4	-	>100
23.0	33	50/2	-	>100
24.0	33	44	50/5	>100
25.0	44	50/5	-	>100
26.0	36	50/2	-	>100
27.0	30	37	47	84
28.0	44	50/8	-	>100
29.0	44	50/5	-	>100
30.0	50/2	-	-	>100
31.0	35	50/2	-	>100
32.0	39	50/5	-	>100
33.0	37	50/6	-	>100
34.0	44	50/6	-	>100
35.0	23	30	50/6	>100
36.0	26	40	50/2	>100
37.0	31	50	50/2	>100
38.0	25	44	50/3	>100
39.0	32	43	50/4	>100
40.0	28	49	50/4	>100
41.0	25	40	50/3	>100
42.0	20	28	38	66
43.0	25	38	46	84
44.0	27	39	50/6	>100
45.0	30	50/5	-	>100
46.0	42	50/6	-	>100
47.0	47	50/8	-	>100
48.0	41	50/12	-	>100
49.0	44	50/10	-	>100
50.0	43	50/13	-	>100

LAYER №	LAYER THICKNESS, m	DEPTH OF LAYER BASE, m	ABSOLUTE ELEVATION OF LAYER BASE, m	LITHOLOGIC DESCRIPTION OF ROCKS	LEVEL OF UNDERGROUND WATERS, m
1	0.6	0.6		Sand, fine, gray, watery, with shell rock mixture	▼0.6
2	3.9	4.5		Clay soil, semihard consistency, light yellowish-gray, weathered, with thin sand interlayers	
				One-coloured, sandy-clayey alternation series with lithologic composition. Thickness of interlayers is 2-8 cm. Sand is mainly alevro-psammitic, fine and very fine-grained, vey dense (siltstone). Clay, gray, dark-gray, very dense and hard consistency (mudstone-type), sandy, schistous. In alternation series the clayey interlayers are prevalent (60-70%).	

BLOWS: 20 40 60 80 100

LITHOLOGIC SECTION

Scale: 1:200

Yashma Gas Combined Thermal Power Plant

Figure 5.2-18 Boring Log No.1

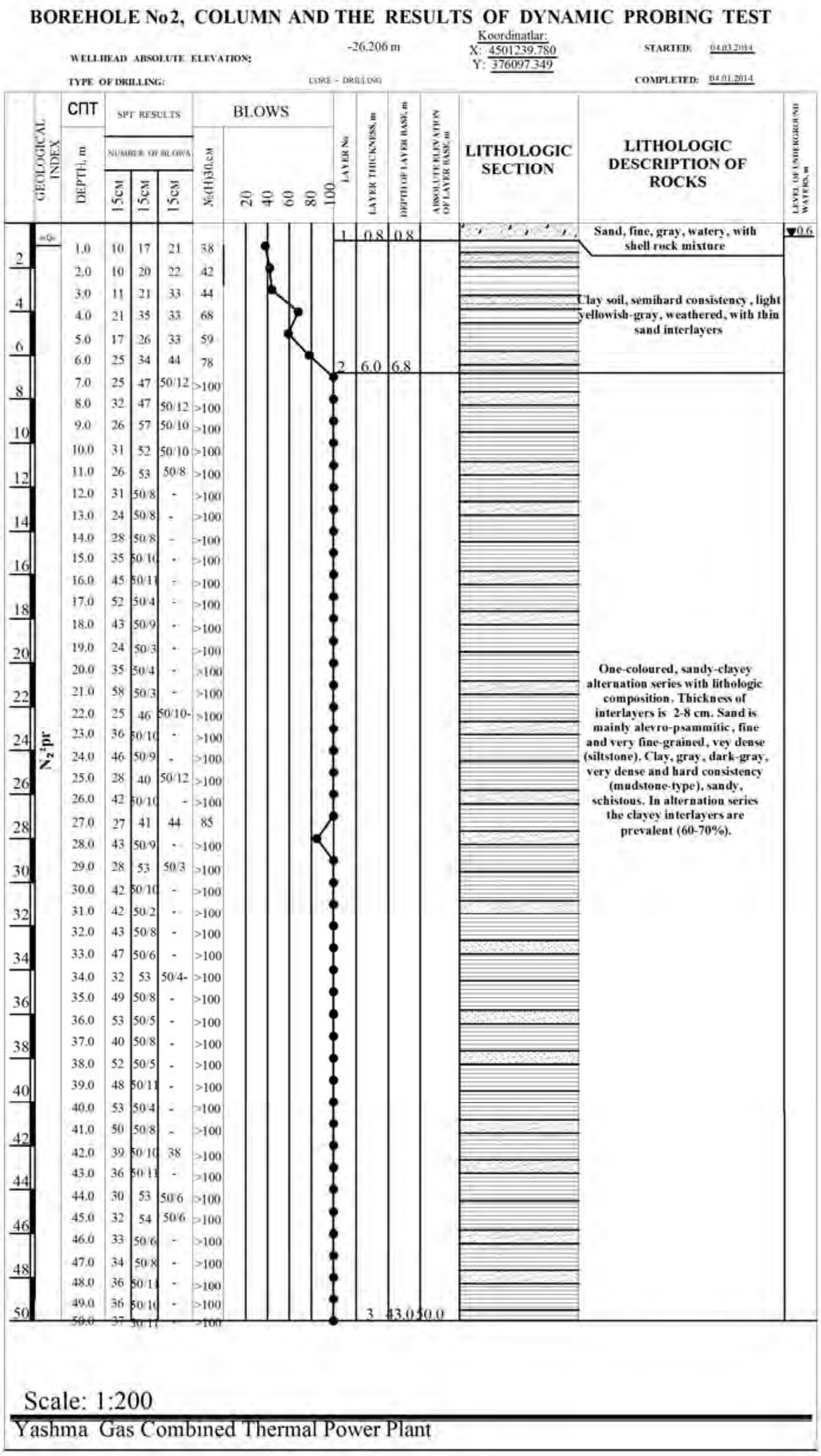


Figure 5.2-19 Boring Log No.2

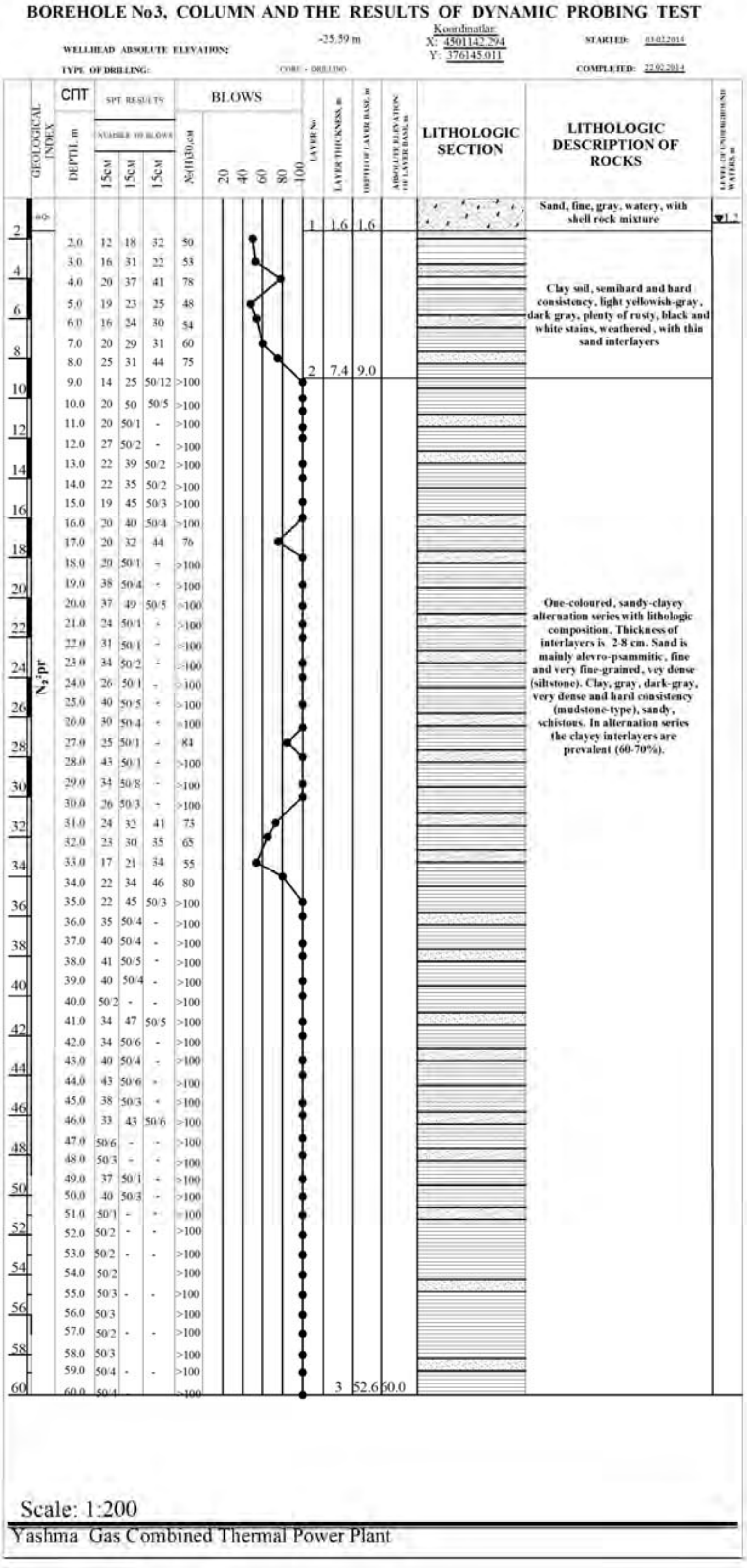


Figure 5.2-20 Boring Log No.3

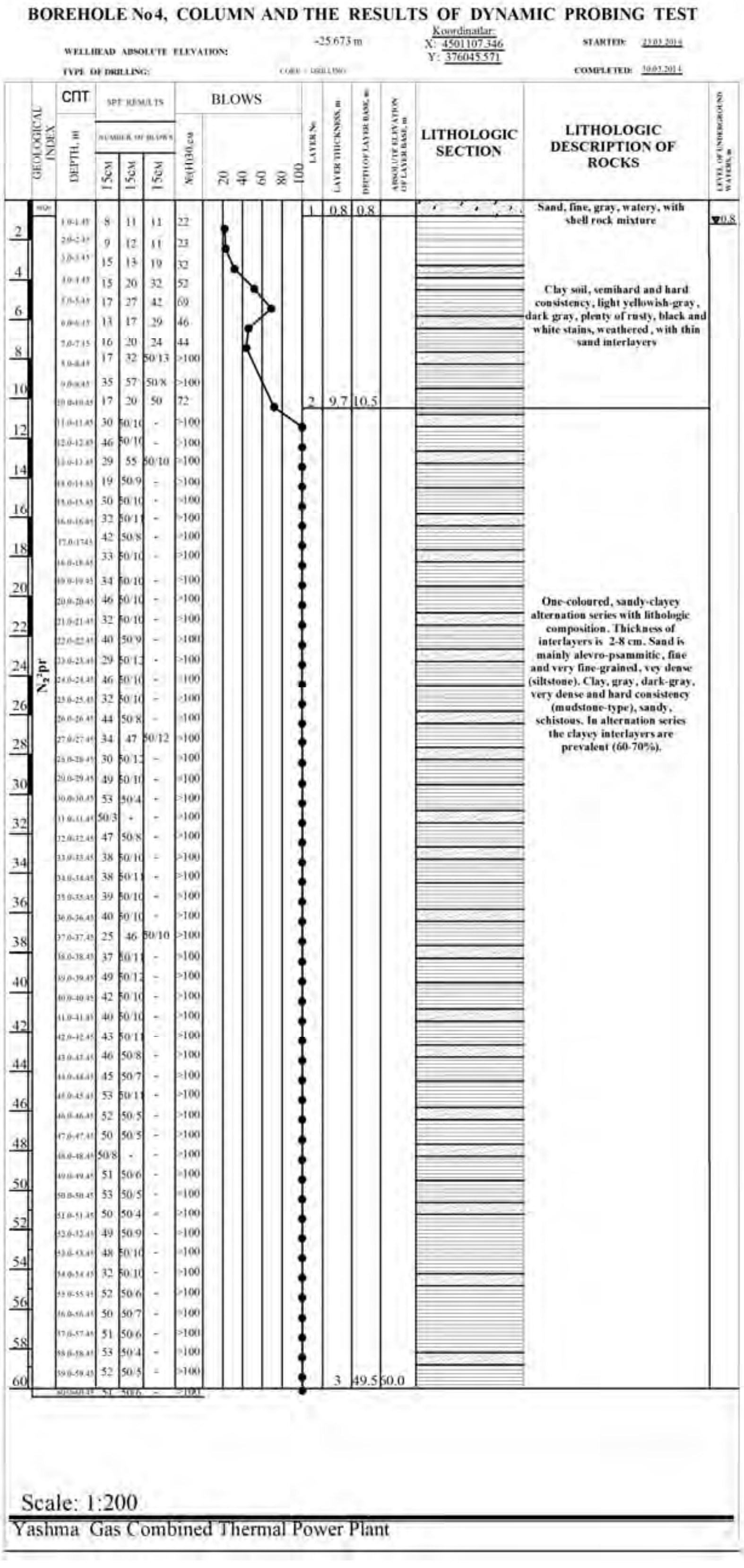
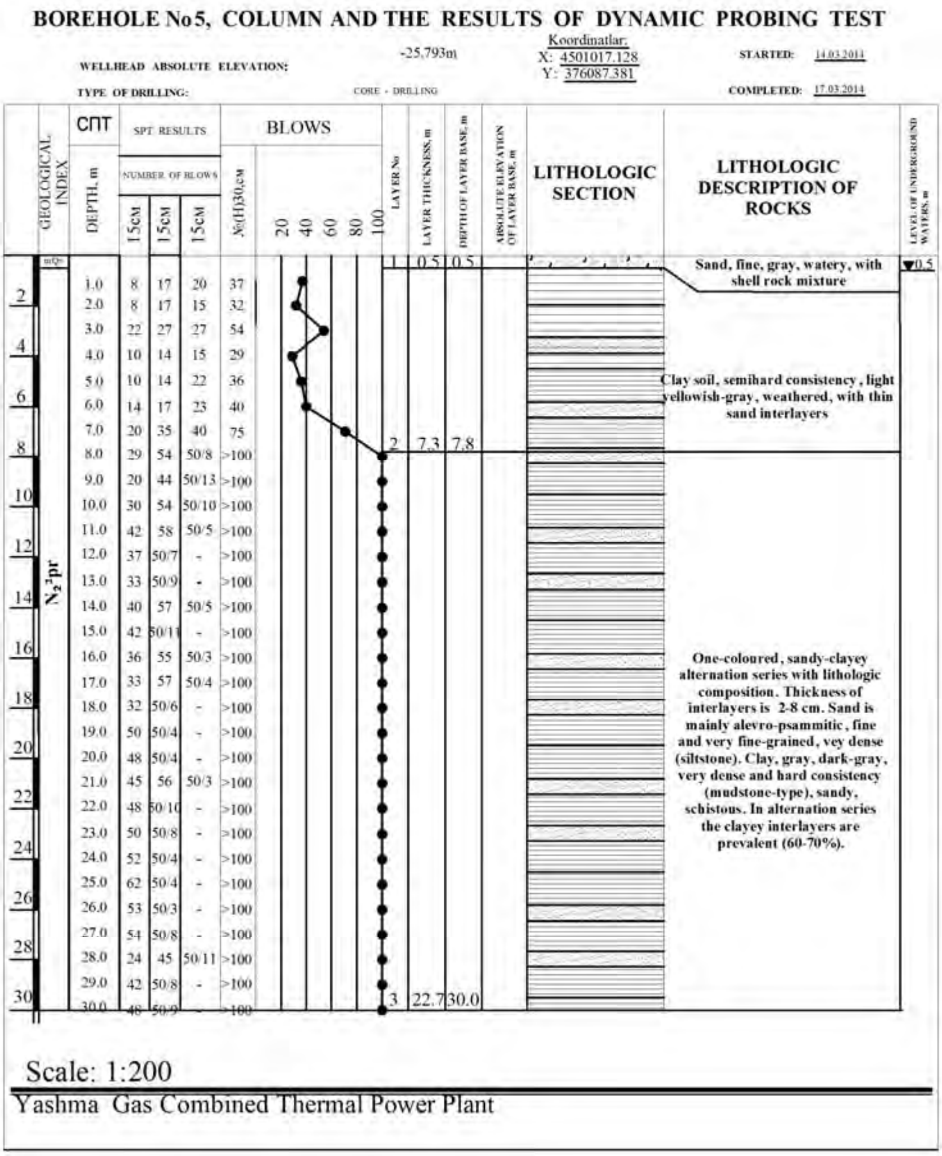


Figure 5.2-21 Boring Log No.4



BOREHOLE No5, COLUMN AND THE RESULTS OF DYNAMIC PROBING TEST

WELLHEAD ABSOLUTE ELEVATION: -25.793m

Koordinatlar: X: 4501017.128 Y: 376087.381

STARTED: 14.03.2014

TYPE OF DRILLING: CORE - DRILLING

COMPLETED: 17.03.2014

DEPTH, m	SPT 15cm	SPT 15cm	SPT 15cm	№(H)30,cm
1.0	8	17	20	37
2.0	8	17	15	32
3.0	22	27	27	54
4.0	10	14	15	29
5.0	10	14	22	36
6.0	14	17	23	40
7.0	20	35	40	75
8.0	29	54	50/8	>100
9.0	20	44	50/13	>100
10.0	30	54	50/10	>100
11.0	42	58	50/5	>100
12.0	37	50/7	-	>100
13.0	33	50/9	-	>100
14.0	40	57	50/5	>100
15.0	42	50/11	-	>100
16.0	36	55	50/3	>100
17.0	33	57	50/4	>100
18.0	32	50/6	-	>100
19.0	50	50/4	-	>100
20.0	48	50/4	-	>100
21.0	45	56	50/3	>100
22.0	48	50/10	-	>100
23.0	50	50/8	-	>100
24.0	52	50/4	-	>100
25.0	62	50/4	-	>100
26.0	53	50/3	-	>100
27.0	54	50/8	-	>100
28.0	24	45	50/11	>100
29.0	42	50/8	-	>100
30.0	48	50/9	-	>100

GEOLOGICAL INDEX	LAYER №	LAYER THICKNESS, m	DEPTH OF LAYER BASE, m	LITHOLOGIC DESCRIPTION OF ROCKS	LEVEL OF UNDERGROUND WATERS, m
mQ	1	0.5	0.5	Sand, fine, gray, watery, with shell rock mixture	▼0.5
N_2^3pr	2	7.3	7.8	Clay soil, semihard consistency, light yellowish-gray, weathered, with thin sand interlayers	
N_2^3pr	3	22.7	30.0	One-coloured, sandy-clayey alternation series with lithologic composition. Thickness of interlayers is 2-8 cm. Sand is mainly alevro-psammitic, fine and very fine-grained, vey dense (siltstone). Clay, gray, dark-gray, very dense and hard consistency (mudstone-type), sandy, schistous. In alternation series the clayey interlayers are prevalent (60-70%).	

Scale: 1:200

Yashma Gas Combined Thermal Power Plant

Figure 5.2-22 Boring Log No.5

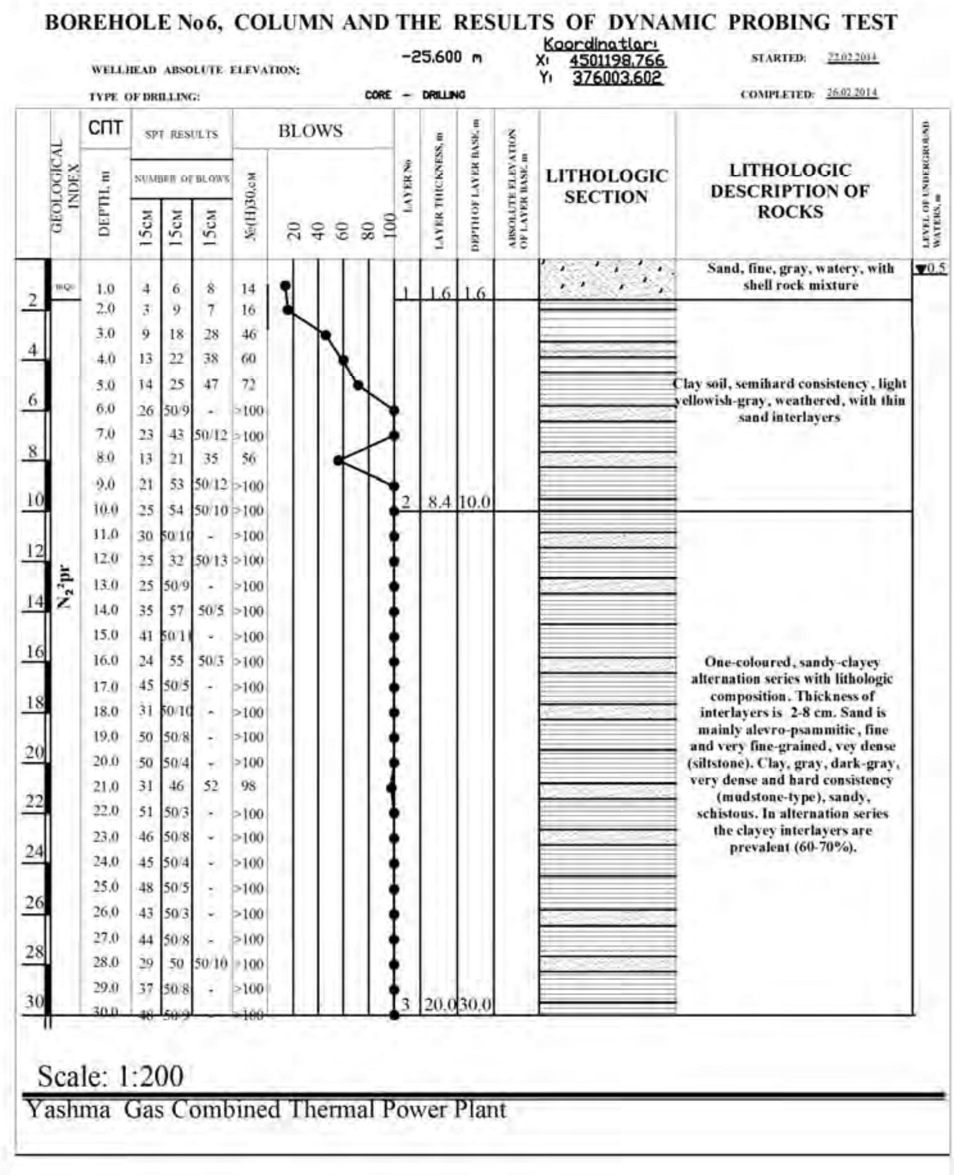


Figure 5.2-23 Boring Log No.6

3) Geological features physical properties table

Geological features physical properties table

G.G.E.-1(mQıv). Sand soil. Thickness of this layer in area is too small and makes no importance as foundation base. This layer will be removed during foundation excavation in any case. Therefore, there is no need for its physico-mechanical characteristics study and recommendation

Table 5.2-10 Geological Features Physical Properties Table

No.	Parameters		Index	G.G.E -2. Clay soil, solid			GGE-3. Clay soil, solid		
				Number of tests	Average value	Limit values	Number of tests	Average value	Limit values
1	Particle-size distribution, fractions %	Sand, 2-0.05 mm	-	33	10.15	2.0-18.8	82	10.53	1.4-52.6
		Dust, 0.05-0.005 mm	-	33	41.8	33.2-51.9	82	39.22	24.8-49.6
		Clay, <0.005 mm	-	33	48.05	31.1-58.6	82	50.25	15.7-73.8
2	Natural moisture, f.u.		W	88	0.22	0.16-0.30	209	0.19	0.05-0.23
3	Density, g/cm^3	At natural moisture	ρ	20	1.89	1.70-2.00	46	1.96	1.75-2.14
		Dry soil	ρ_d	20	1.54	1.35-1.66	46	1.65	1.45-1.83
4	Rock particles density, g/cm^3		ρ_s	20	2.75	2.73-2.76	46	2.75	2.74-2.76
5	Porosity, %		n	20	43.9	39.2-50.8	46	40.1	33.4-47.1
6	Void ratio		ε	20	0.790	0.643-1.032	46	0.672	0.501-0.891
7	Moisture degree		Sr	20	0.80	0.63-0.94	46	0.78	0.60-0.95
8	Total moisture capacity		W_{sat}	20	0.29	0.24-0.38	46	0.24	0.18-0.33
9	Plasticity number		J_P	89	0.24	0.17-0.34	209	0.24	0.17-0.45
10	Fluidity index (consistency)		J_L	89	-0.27	-1.22-(+0.10)	209	-0.37	-0.98-(+0.02)
11	Modulus of deformation, MPa (natural)		E	5	14.7	8.7-27.9	18	25.1	5.2-58.2
12	Compression coefficient, cm^2/kg		a	5	0.005	0.002-0.008	11	0.005	0.002-0.015
13	Cohesive strength, kPa		c	7	58	45-100	18	62	26-103
14	Angle of internal friction, degree		φ	7	17°30"	14°02`-21°03`	11	16°30'	11°19`-19°02`
15	Carbonation, %		$CaCO_3$	3	2.3	1.7-3.4	20	2.4	0.8-6.3
16	Organic matters, %		J_{OM}	5	1.9	1.6-2.7	22	1.6	0.3-2.5
17	Number of SPT blows		N(30)	42	53	14- >100	238	>100	54- >100

5.2.5 Soil Investigation (Offshore Boring)

(1) Outline

On the construction site field investigations started on 28nd Jun 2014 and were completed on 29th Jun. Engineering-geological investigation works consist of the followings;

- Visual check of the area and surroundings related to geological engineering, geological and hydrogeological conditions;
- Mechanical-core boring & sampling;
- Laboratory studies;
- Standard penetration test (SPT);
- Office studies.

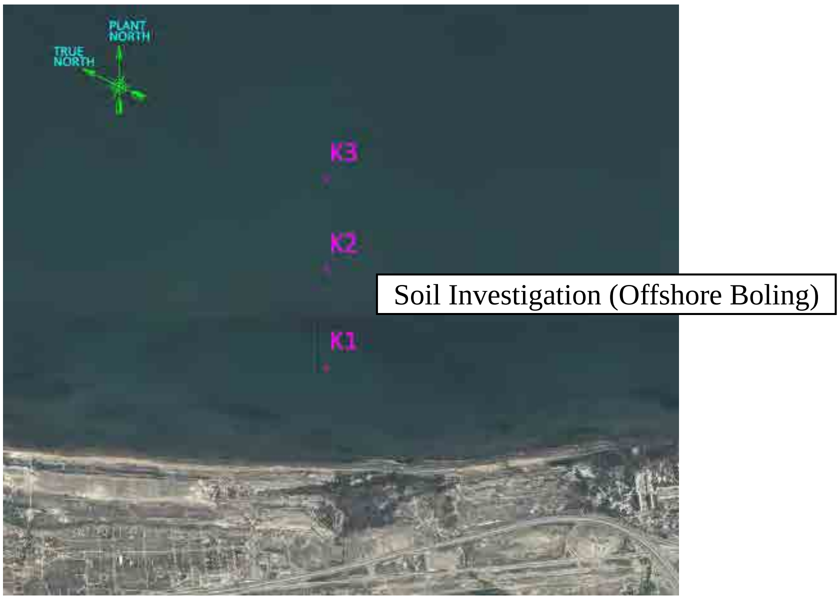


Figure 5.2-24 Measure Range

Table 5.2-11 Bore Position

№	Thing	Borehole №	Depth of borehole m	Axis X	Axis Y	Absolute height and m.(H)
1	Intake pipe	K-1	6.0	376961.864	4501242.136	-32.08
2		K-2	6.0	377649.948	4501583.028	-34.68
3	Intake tower	K-3	10.0	378813.203	4502164.968	-35.80

1) Area layout

Survey area is situated in the north part of Sumgait city, in the territory of H.Z.Tagiev settlement, in the west coast of Caspian Sea.

Figure 5.2-25 General View of Investigated Area

(2) Result of Soil investigation

1. Engineering-geological survey works were carried out by means of Jack- Up "C-1000" drilling machine within 28.06.2014 - 29.06.2014.
2. From administrative standpoint, survey area is situated in the south-east part of Great Caucasus in Khizi region territory.
3. As a result of combined study of field and laboratory data of soil samples, 3 geological engineering elements (GEE) with 2 different lithologic compositions were separated in the geologic structure of the area.
   Normative and design parameters of main physic-mechanical indices of the selected geological engineering elements were defined. Mainly, GEE- 2 elements prevail in the area and it was not opened (revealed) with complete thickness.

1) Geological profile

Figure 5.2-26 shows a geological section.

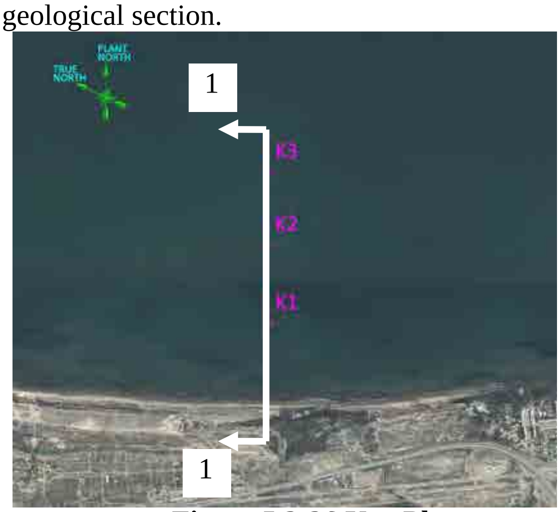


Figure 5.2-26 Key Plan

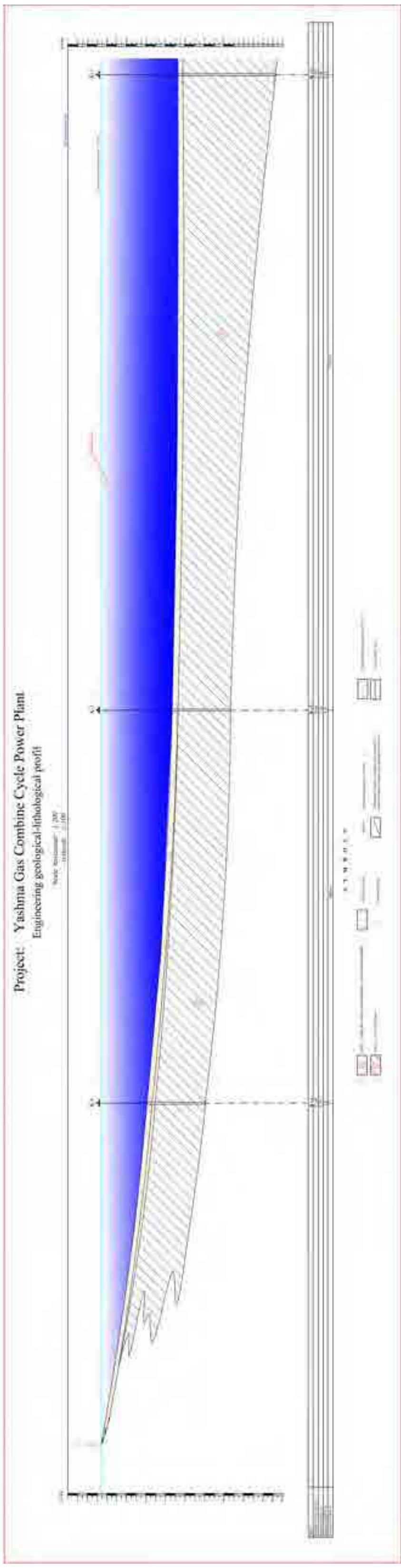


Figure 5.2-27 1-1 Cross Section

2) Geologic columnar section

Figure 5.2-28-Figure 5.2-30 shows the geologic columnar section.

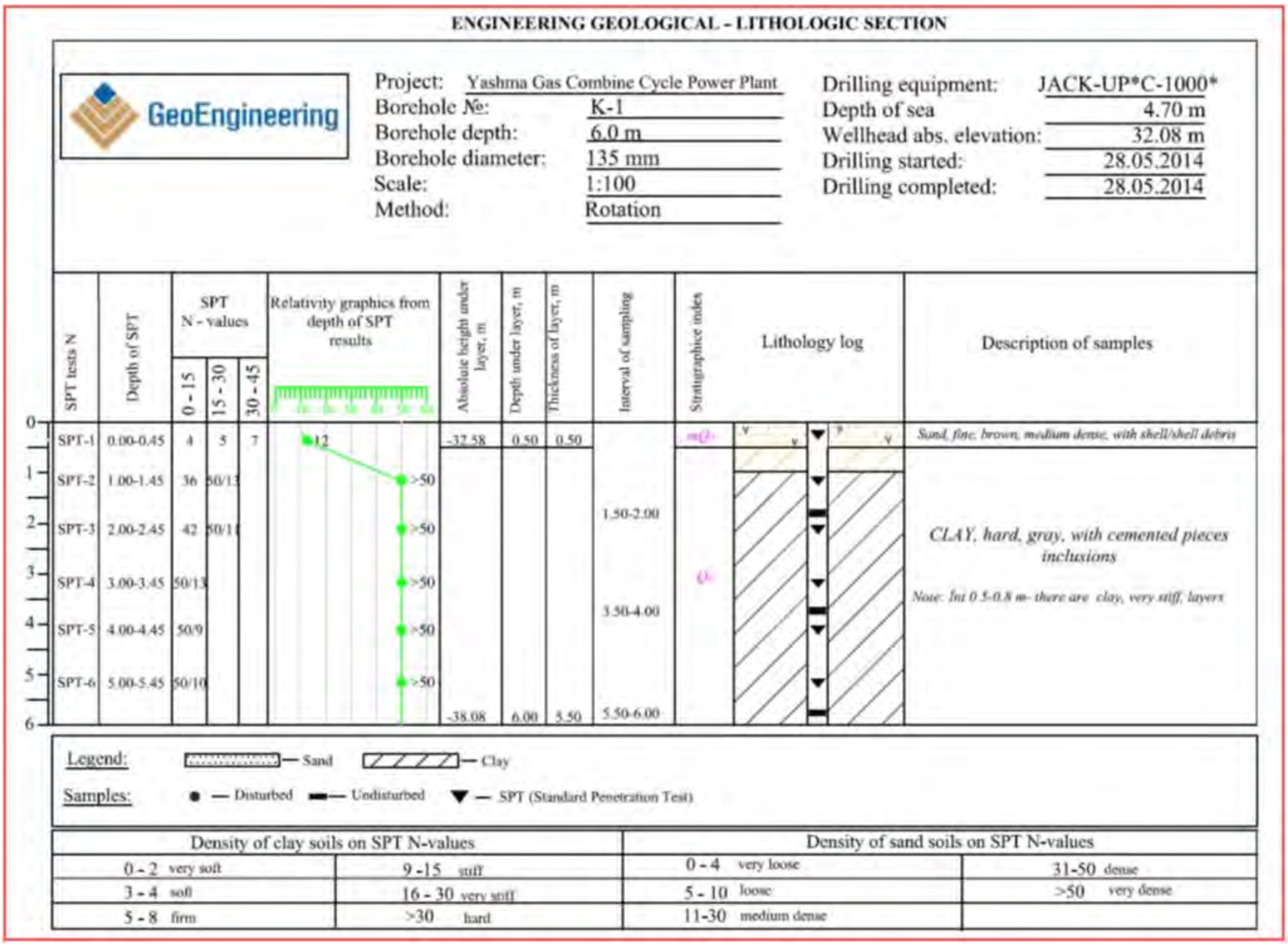


Figure 5.2-28 Boring Log No.K-1

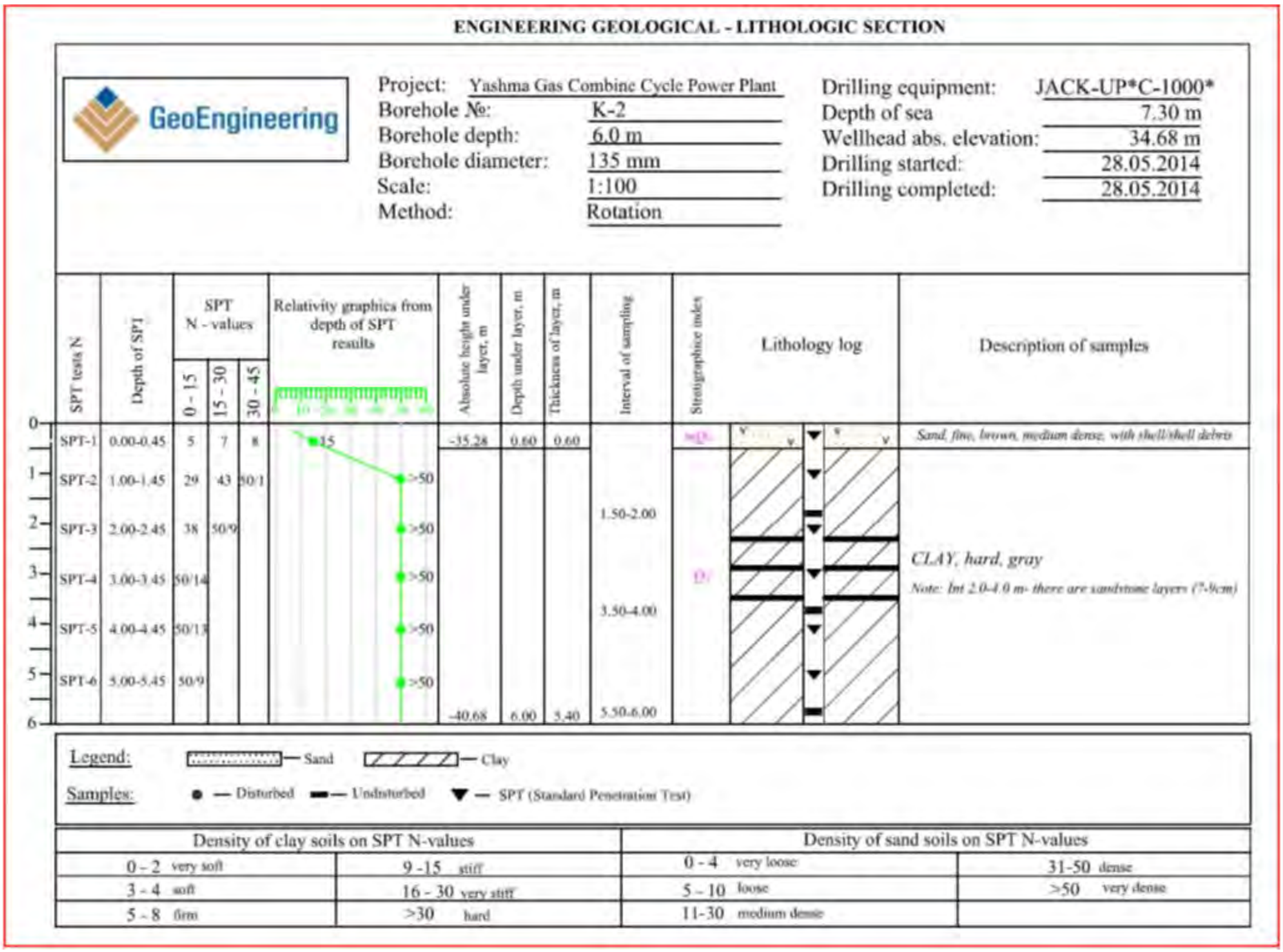


Figure 5.2-29 Boring Log No.K-2

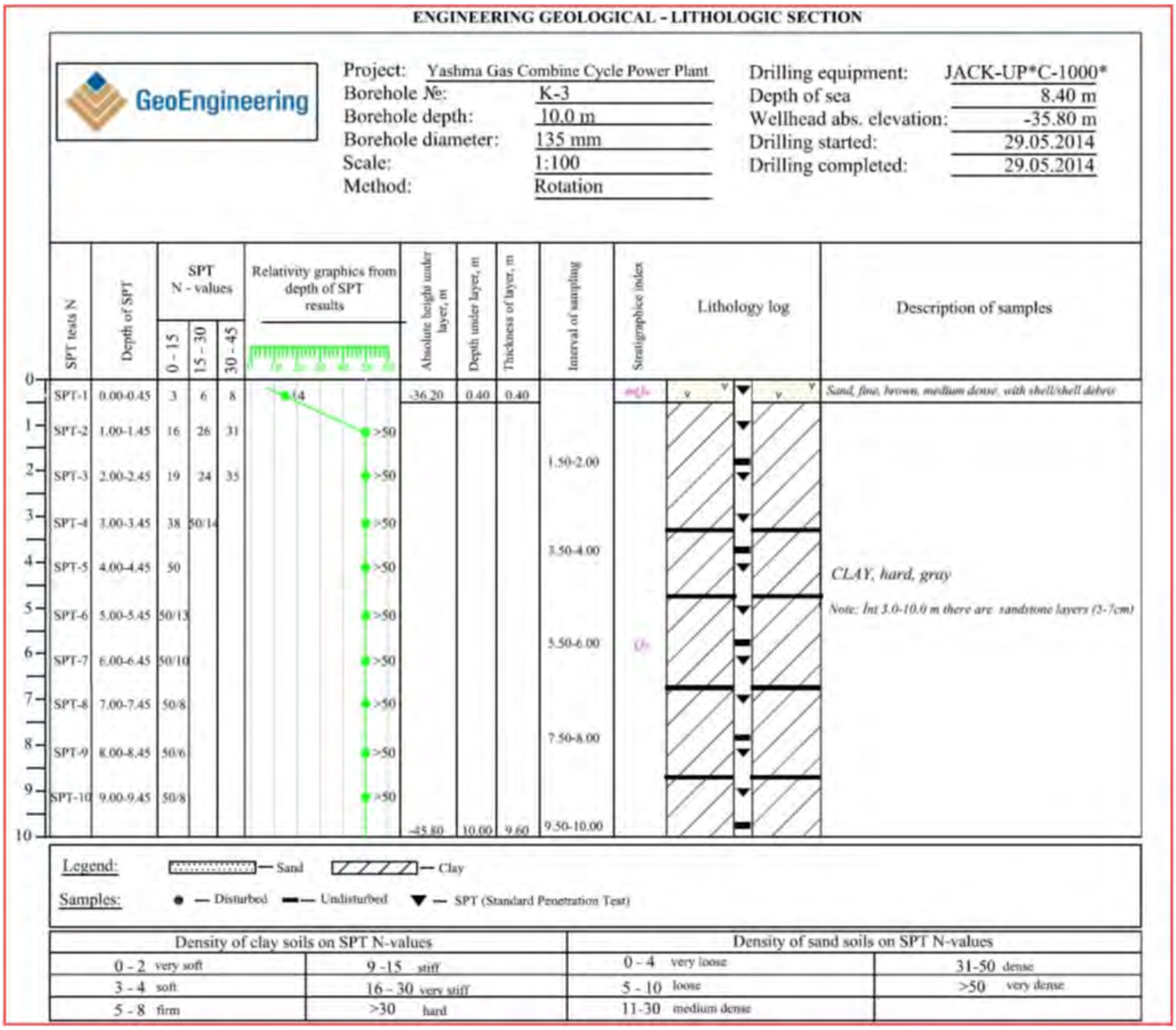


Figure 5.2-30 Boring Log No.K-3

3) Geological features physical properties table

GEE (Geologic Engineering Element) can be separated from these 2 lithologic units.

Table 5.2-12 2 Lithologic Units

1.(mQIV) EGE-1	**Sand, fine, brown, medium dense, with shell/shell debris** Minimum thickness of this element is 0.40 m, maximum thickness – 0.60 m, average thickness – 0.50 m.
2.(QIV) EGE -2	**CLAY, hard, gray,** Minimum thickness of this element is 5.40 m, maximum thickness – 9.60 m, average thickness – 6.83 m. It should be noted that, this element on the area is not opened with complete thickness.

Table 5.2-13 Geological Features Physical Properties Table(EGE-1 Sand)

No.	Physic-mechanical characteristics	Index	Number of tests	Average value	Limit values
1	Natural moisture, %	W	–	26.3	
2	Density, g/cm3	ρ	–	1.65	
3	Rock particles density, g/cm3	ρ d	–	1.56	
4	Rock particles density, g/cm3	ρ d.min	–	1.29	
5		ρ d.max	–	1.63	
6	Specific gravity, g/cm3	ρ s	–	2.66	
7	Porosity	e	–	0.70	
8	Standard Penetration Test	SPT	–	13.7	12-15

Table 5.2-14 Geological Features Physical Properties Table(EGE-2 Clay)

No.	Physic-mechanical characteristics	Index	Number of tests	Average value	Limit values
1	Natural moisture, %	W	3	21.6	19.0-23.1
2	Density, g/cm3	ρ	3	2.03	1.96-2.08
3	Rock particles density, g/cm3	ρ d	3	1.65	1.59-1.75
4	Specific gravity, g/cm3	ρ s	3	2.76	2.75-2.77
5	Porosity factor	e	3	0.67	0.58-0.73
6	Liquid limit	WL	3	26.3	23.3-28.1
7	Plasticity limit	WP	3	54.2	48.5-57.5
8	Plasticity index	PI	3	27.9	25.2-29.4
9	Consistency	IL	3	<0	<0
10	Percentage value of mass from <75μm sieve mesh	<75μm	3	90.1	82.5-97.3
11	Internal friction angle	ϕ	3	19° 10'	18° 00'-20° 50'
12	Cohesive strength, kg/cm2	C	3	0.42	0.42-0.43
13	Consolidation test, kPa	G	3	647	521-737
14	Uniaxial compression test (UCT)	UCT	3	563	365-868

Chapter 6

Fuel Supply Plan

(A part of this chapter has been removed because of confidential information.)

Chapter 6 Fuel Supply Plan

6.1 Natural Gas Reserves in Azerbaijan

The British Petroleum (BP) statistical review of world energy stated that proven natural gas reserves in Azerbaijan register an abundant figure of 0.9 trillion cubic meters (hereinafter referred to as "Tcm") as of June 2013. Azerbaijan is classified under Europe and Eurasia.

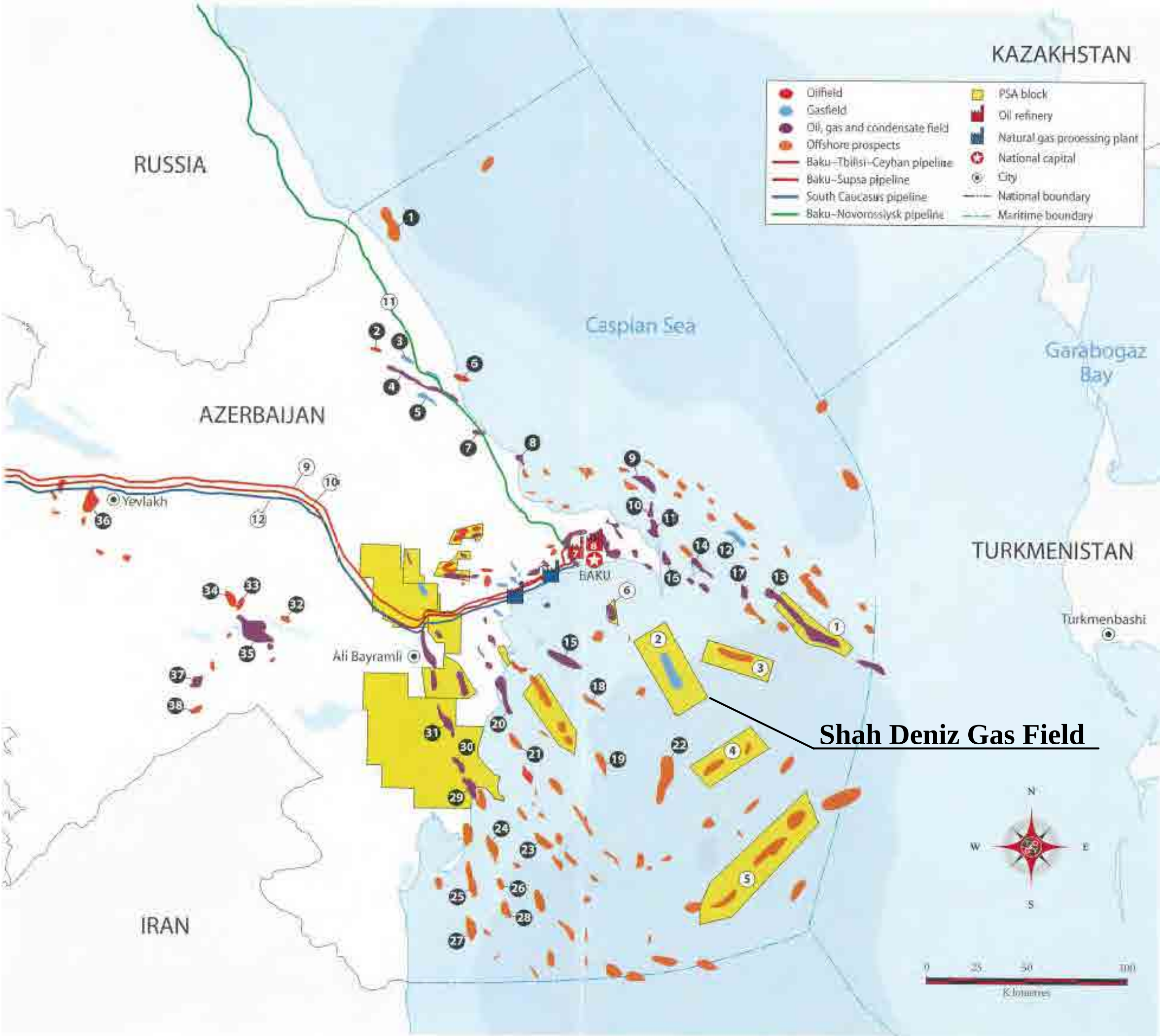
The following illustrates the transition of the proven natural gas reserves in Europe and Eurasia. Azerbaijan's proven natural gas reserves are 0.9 Tcm at the end of 2012.

Table 6.1-1 Amount of Proven Natural Gas Reserves in Europe and Eurasia

Year / Country	At end 1992 (Tcm)	At end 2002 (Tcm)	At end 2011 (Tcm)	At end 2012 (Tcm)
Azerbaijan	**n/a**	**0.9**	**0.9**	**0.9**
Denmark	0.1	0.1	0.0	0.0
Germany	0.2	0.2	0.1	0.1
Italy	0.3	0.2	0.1	0.1
Kazakhstan	n/a	1.3	1.3	1.3
Netherlands	1.7	1.4	1.0	1.0
Norway	1.4	2.1	2.1	2.1
Poland	0.2	0.1	0.1	0.1
Romania	0.5	0.3	0.1	0.1
Russian Federation	n/a	29.8	32.9	32.9
Turkmenistan	n/a	2.3	17.5	17.5
Ukraine	n/a	0.7	0.7	0.6
United Kingdom	0.6	1.0	0.2	0.2
Uzbekistan	n/a	1.2	1.1	1.1
Other Europe & Eurasia	34.7	0.4	0.3	0.3
Total Europe & Eurasia	39.6	42.1	58.4	58.4

Source: BP Statistical Review of World Energy June 2013

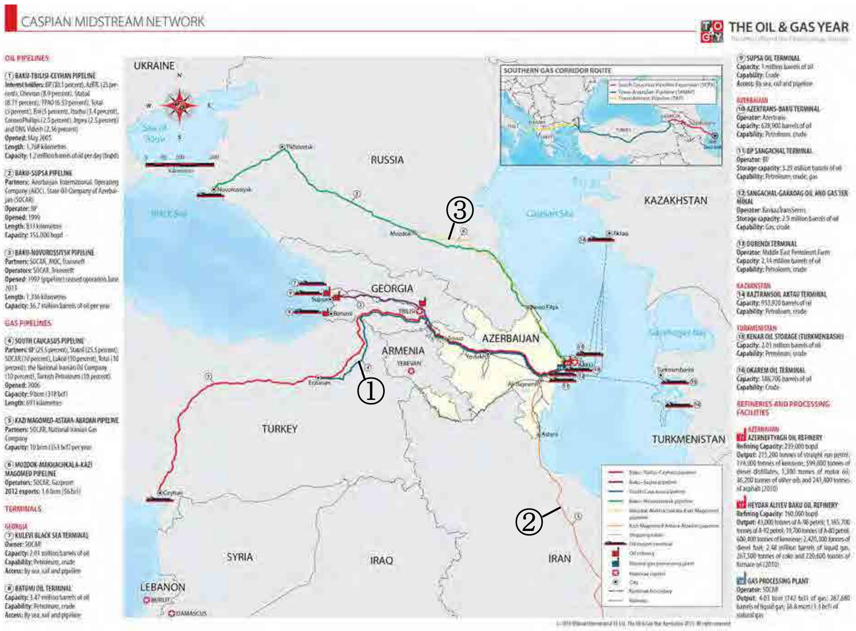
The gas fields are concentrated offshore the Caspian Sea in the southeast of Baku (See Figure 6.1-1). The Shah Deniz gas field, approx. 70km southeast of Baku, is the largest natural gas field in Azerbaijan. The Shah Deniz gas field is operated by the State Oil Company of Azerbaijan Republic (SOCAR), BP and others. SOCAR is a state owned oil and natural gas corporation. A production-sharing agreement (PSA) regarding Shah Deniz was reached in 1996 and is set to expire in 2036. Production began in 2006. Production volume is 27 million cubic meters (mcm) of gas per day. Figure 6.1-1 shows Oil and Gasfield and offshore PSA areas.



Source: SOCAR, the oil & gas year

Figure 6.1-1 Oil and Gasfield and Offshore PSA Areas

There are three (3) international networks of gas pipelines in Azerbaijan. The first is ①the South Caucasus pipeline to Turkey through Georgia (opened 2006, capacity 9 bcm per year, length 691 kilometers). The second is ②the Kazimagomed-Astara-Abadan pipeline to Iran (capacity 10 bcm per year). And the last is ③the Mozdok-makhachakala-Kazi Magomed pipeline to Russia (exported 1.6 bcm in 2012). Figure 6.1-2 shows the Caspian Midstream Network.



Source: SOCAR, the oil & gas year

Figure 6.1-2 Caspian Midstream Network

Table 6.1-2 shows natural gas development projects in Azerbaijan by SOCAR. Projects currently being implemented by the multinational corporations and SOCAR are based on natural gas exploration licenses. The development of these gas fields are expected to increase Azerbaijan's proven natural gas reserves.

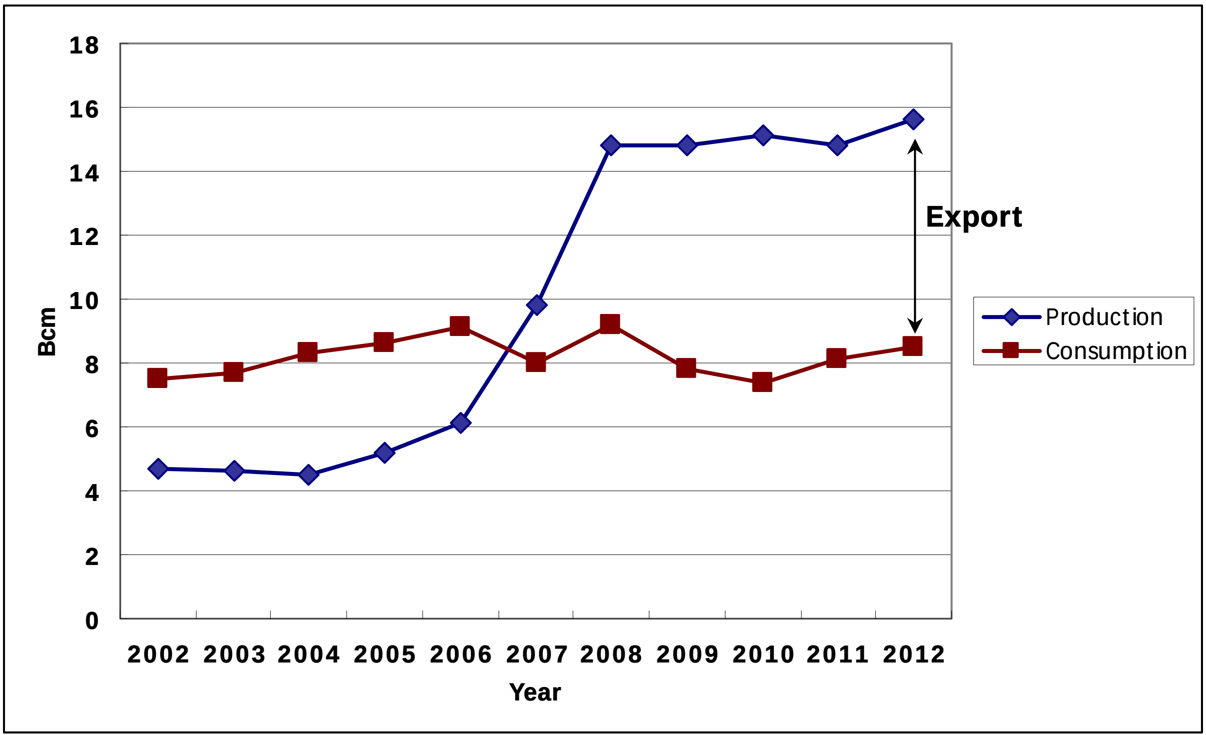
Table 6.1-2 Natural Gas Development Projects in Azerbaijan by SOCAR with Partner

Field	Expected Operation Start	Partner	Reserve
Shah Deniz Gas Field phase-2	2018	BP (British), Statoil (Norway), Lukoil (Russia), NICO (Iran), Total (France), TPAO (Turkey)	0.445-0.670 Tcm
Absheron Gas Field	2021-2025	Total (France), Gdf (France)	0.30-0.35 Tcm
ACG deep seabed Gas Field	2021-2025	Under negotiation	0.3-0.4 Tcm
Shafag-Asiman Gas Field	2030	BP (England)	0.3-0.5 Tcm
Umid Gas Field	2030	-	0.2 Tcm

Source: Report by Ministry of Foreign Affairs of Japan

6.2 Production and Consumption Volumes of Natural Gas in Azerbaijan

The following describes the proven production and consumption volumes of natural gas in Azerbaijan during the period from 2002 to 2012. The natural gas production volume registers a gradual increase after 2002 to reach a peak value of 15.6 Billion cubic meters (hereinafter referred to as "Bcm") in 2012. Further, since Azerbaijan does not import natural gas, the difference between production and consumption volumes indicates the amount of export. The export volume in 2012 was 7.1 Bcm, which represents approximately 46 percent of total production.



Source: BP Statistical Review of World Energy 2012

Figure 6.2-1 Proven Production and Consumption Volumes of Natural Gas (2002-2012)

Table 6.2-1 shows the Reserve/Production (R/P) Ratio obtained by calculation based on the reserves of natural gas and consumption. R/P ratios represent the length of time that those remaining reserves would last if production were to continue at the previous year's rate. It is calculated by dividing remaining reserves at the end of the year by the production in that year. The R/P is an index that shows how many years natural gas can be produced continuously in the future.

The R/P for Azerbaijan was 57.7 years as of 2012. This is estimated to be due to an increase in proven natural gas reverses owing to the development of gas fields currently underway. When consideration is given to the continued development of gas fields in the future, sufficient reserves can be estimated, even if the lifetime of this project is assumed to be 25 years.

Table 6.2-1 Reserves / Production Ratio of Natural Gas

Items	Unit	At end 2002	At end 2011	At end 2012
Proved reserves	Tcm	0.900	0.900	0.900
Production	Tcm	0.0047	0.0148	0.0156
R/P ratio	Year	191.5	60.8	57.7

Source: BP Statistical Review of World Energy 2012

6.3 Possibility of Gas Supply to Yashma

6.3.1 Candidate Site of Natural Gas Supply

According to earlier information from Azerenerji JSC, there exists one (1) gas pipeline 300m southeast from the Yashma site. Though this pipeline is available for the Yashma power plant, based on new information from SOCAR the pipeline's supply pressure and volume are not sufficient for the Yashma power plant project: the pipeline's supply pressure is approx. 5 bar and it is normally used for residential consumers but the Yashma project requires a minimum pressure level of 20-30 bar at the project site boundary. Figure 6.3-1 is a photo of the existing gas pipeline 300m southeast from Yashma site by the study team.

Source: Study team

Figure 6.3-1 Existing Gas Pipeline beside of Yashma Site

Azerenerji JSC submitted the official letter to SOCAR regarding the Yashma project. Required Gas volume is 200,000m^3/hour for the Yashma project as described in the official letter. Azerenerji JSC and the study team had meetings with SOCAR on the possibility of gas supply, and SOCAR, Azerenerji JSC and the study team conducted joint site surveys and discussions regarding some candidate sites. After these joint site surveys and discussions, they identified a possibility of gas pipeline routes from three candidate sites, ①Siezen, ②Khizi and ③Sumgayit. Figure 6.3-2 shows a gas pipeline map with the three candidate routes. The Siezen site (gas compressor station) is located approx. 70km northwest of the Yashma site. The Siezen Gas Compressor Station has six (6) gas compressors with mechanical drive gas turbines. Figure 6.3-3 shows an aerial photograph of the Siezen Gas Compressor Station. Khizi was selected as satisfying the minimal-length of a gas pipe from Yashma. Sumgayit is the closest candidate site, however, and there are some houses and community blocks in its vicinity.

Source: Google earth

Figure 6.3-2 Gas Pipeline Map with Three Candidate Gas Pipeline Routes

Source: Google earth

Figure 6.3-3 Siezen Gas Compressor Station

Study team prepares basic comparison table as follows;

Table 6.3-1 Comparison of Three (3) Candidate Sites for Gas Supply

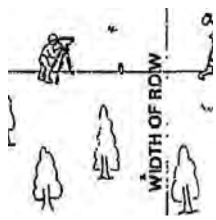
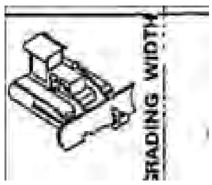
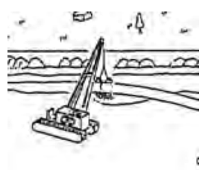
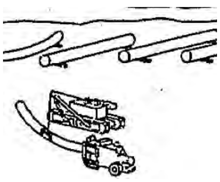
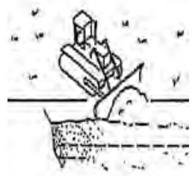
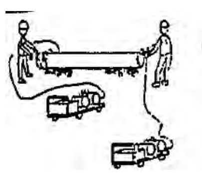
Items	Candidate Site		
Name	① Siezen	② Khizi	③ Sumgayit
(1)Gas pipeline route	Yashma to Siezen Gas Compressor Station	Yashma to Khizi (selection of minimal-length)	Yashma to Sumgayit
(2)Distance	70 km	30-40 km	10-20 km
(3)Land form	Flat	Difference in elevation is approx. 700m from Yashma to tie-in point.	Flat
(3)Gas Supply Volume	Sufficient (Information from SOCAR)	Sufficient (Information from SOCAR)	Not Sufficient
(4)Gas Supply Pressure	Sufficient, but lower than Khizi (Information from SOCAR)	Sufficient (Information from SOCAR)	Not Sufficient
(5)Gas Compressor	New gas compressor will not be required (Information from SOCAR). There are 6 (Six) compressors in Siezen gas station.	New gas compressor will not be required (Information from SOCAR).	-
(6)Right of Way (ROW)	Clear (There is existing pipeline from Yashma to Siezen.)	Clear (Route selection & survey was done.)	Difficult (Some houses and communities block the way.)
(7)Pipeline Construction (transport the pipe to ROW, heavy equipment access)	Clear (There is a highway beside the existing pipeline.)	Clear (There is a highway beside the new pipeline route and no residential area)	Difficult (Some houses and communities block the way.)
Project Cost	Higher than Khizi	Lower than Siezen	‘-
Evaluation	Future Candidate	Acceptable	Not Acceptable

The above table suggests that Khizi is superior to Siezen and Sumgayit as a candidate construction site for Gas Supply.

Thus, candidate side Khizi is recommended as a construction site for a new gas pipeline.

6.3.2 Procedure of Gas Pipeline Construction

This section describes a general overview of the gas pipeline construction procedure. Figure 6.3-4 presents an overview of gas pipeline construction procedure.

(1)	**Route selection & survey of ROW**		**(5)**	**Excavation of pipe trench**	
	↓			↓	
(2)	**Preparation of ROW**		**(6)**	**Lowering of gas pipeline**	
	↓			↓	
(3)	**Stringing & bending of gas pipeline**		**(7)**	**Backfilling & test of gas pipeline**	
	↓			↓	
(4)	**Welding of gas pipeline**		**(8)**	**Clean-up of ROW**	

Source: Study team

Figure 6.3-4 Overview of Gas Pipeline Construction Procedure

(1) Route selection & survey of ROW
Route selection focuses on minimizing the potential environmental impacts to protected areas, agricultural lands, houses, communities, etc. After finalizing the gas pipeline route, the entire ROW will be surveyed. The ROW encompasses the new pipeline route as well as construction space (width is normally 20m).

(2) Preparation of ROW
Prior to pipeline installation, the ROW will be cleared of trees and bushes.

(3) Stringing & bending of gas pipeline
The pipe will be transported to the ROW. The pipe will be strung and bent where necessary to allow for fitting the pipeline.

(4) Welding of gas pipeline
Individual lengths of the gas pipeline will be joined using welding machines.

(5) Excavation of gas pipeline
The project will excavate the pipe trench with specialized equipment according to site conditions.

(6) Lowering in & tie-ins of gas pipeline
Gas pipeline will be lowered into a trench.

(7) Backfilling & testing of gas pipeline
The trench is backfilled using excavated material to prevent damage to the pipe. A test will be conducted to evaluate the integrity of the completed pipe.

(8) Clean-up of ROW
The ROW will be restored.

6.3.3 Gas Pipeline System

This part has been removed because of confidential information.

6.3.4 Possibility of Gas Pipeline Construction

This part has been removed because of confidential information.

Chapter 7

Network Analysis and Grid Connection Plan

Chapter 7 Network Analysis and Grid Connection Plan

7.1 Network Analysis

7.1.1 Present Power Transmission Network

(1) Network Configuration

The current transmission network of Azerbaijan as of 2014 is illustrated in Figure 7.1-1. The capital city of Baku (population 2 million) is located in the eastern part of the country. Baku constitutes the center of power consumption. The largest power plants are located in the central part of the country, and this area serves as the country's supply center.

In order to supply power to Baku, 500kV and 330kV trunk lines run about 250km from Azerbaijan Substation (SS) to Absheron SS, with a 500/330/220kV main substation located in the suburbs of Baku. Power is supplied from there to urban areas through 220kV transmission lines. The Transmission network of Azerbaijan has interconnections with Russia, Georgia and Iran. The voltages of interconnections are below;

Russia : 330kV
Georgia : 500kV and 330kV
Iran : 330kV, 220kV and 110kV

Network of Turkey is also connected via Georgia with network of Azerbaijan.

(2) Geographical Distribution of Load and Generation

As shown in Figure 7.1-1, Azerbaijan is divided into nine areas, which from west to east are: Ganca, Mingache, Saki, Qabala, Imisli, Xachmaz, Sirvan, Sumgayit and Baku.

A distribution chart of power load and generation for the aforementioned nine areas is presented in Table 7.1-1 and Figure 7.1-2. A percentage breakdown by area of load and generation is shown in Figure 7.1-3.

The percentage breakdown of the total load of 3,794MW at the winter peak is as follows.

Ganca: 13%, Mingache: 5%, Saki: 3%, Qabala: 2%, Imisli: 10%, Xachmaz: 5%, Sirvan: 10%, Sumgayit: 15% and Baku: 37%

Meanwhile, the percentage breakdown of the total generation of 3,857MW is as follows.

Ganca: 7%, Mingache: 37%, Saki: 2%, Qabala: 0%, Imisli: 0%, Xachmaz: 4%, Sirvan: 19%, Sumgayit: 11% and Baku: 20%

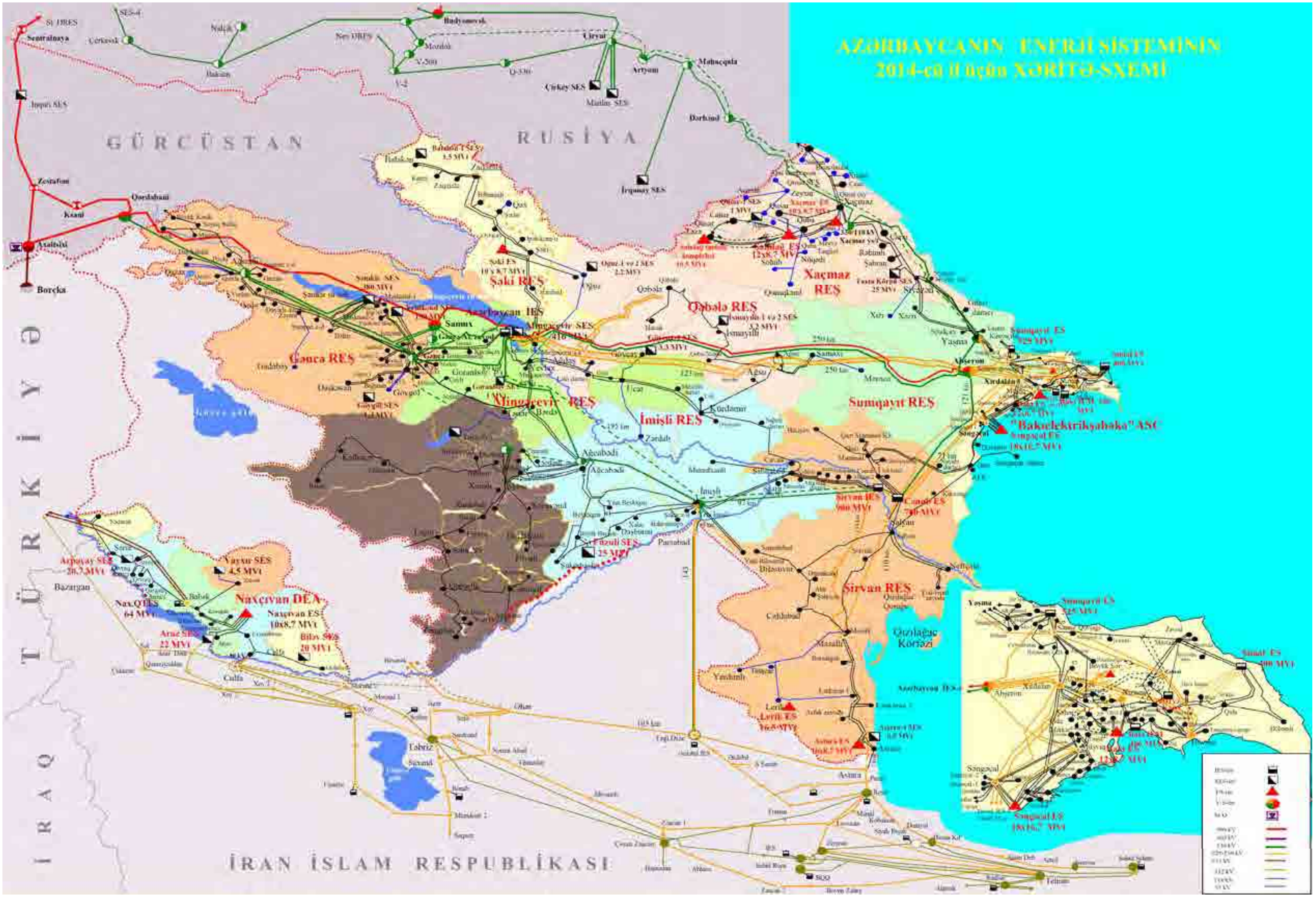
Consequently, power tends to flow from the central area of Mingache, where surplus power exists, to Baku.

A distribution chart of energy consumption as of 2012 is illustrated in Figure 7.1-4.

Table 7.1-1 Distribution Chart of Load and Generation as of 2014 (Unit : MW)

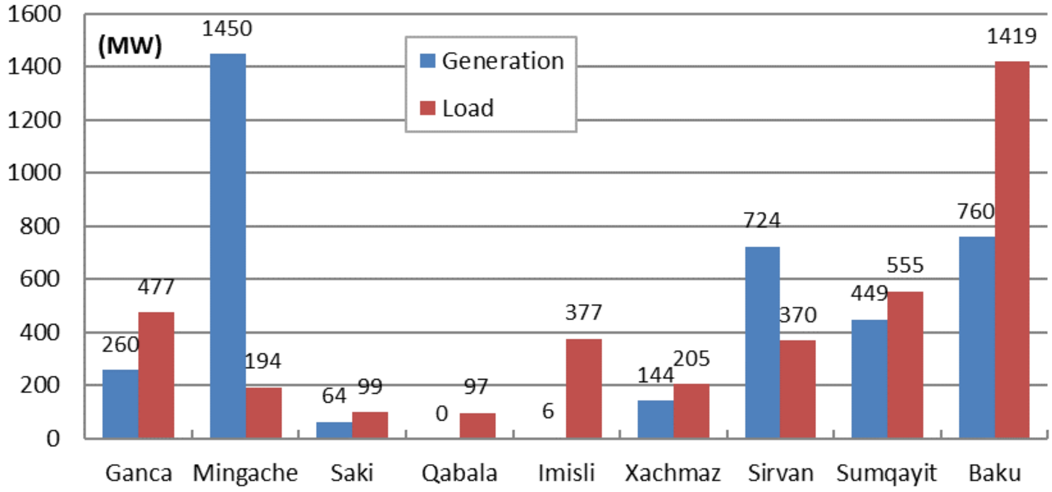
Area	Ganca	Mingache	Saki	Qabala	Imisli	Xachmaz	Sirvan	Sumgayit	Baku	Total
Load	477	194	99	97	377	205	370	555	1,419	3,794
Generation	260	1,450	64	0	6	144	724	449	760	3,857

Source: Network analysis data provided by JSCA



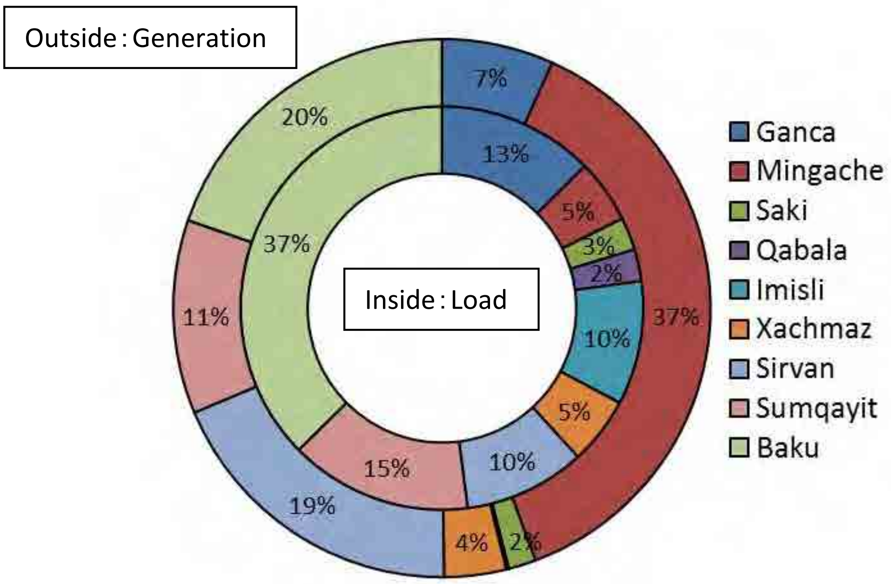
Source : JSCA

Figure 7.1-1 Transmission Network of Azerbaijan as of 2014



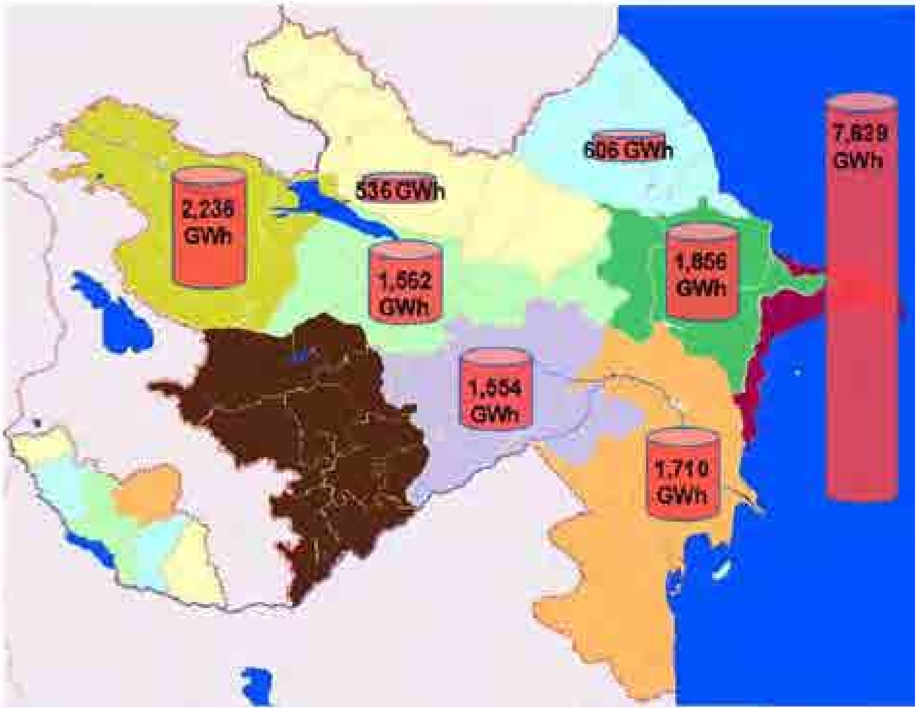
Source: Network analysis data provided by JSCA

Figure 7.1-2 Distribution Chart of Load and Generation as of 2014



Source: Network analysis data provided by JSCA

Figure 7.1-3 Percentage Breakdown by Area of Load and Generation as of 2014



Source: JSCA

Figure 7.1-4 Distribution Chart of Energy Consumption as of 2012

(3) Network System

1) Transmitting Capacity

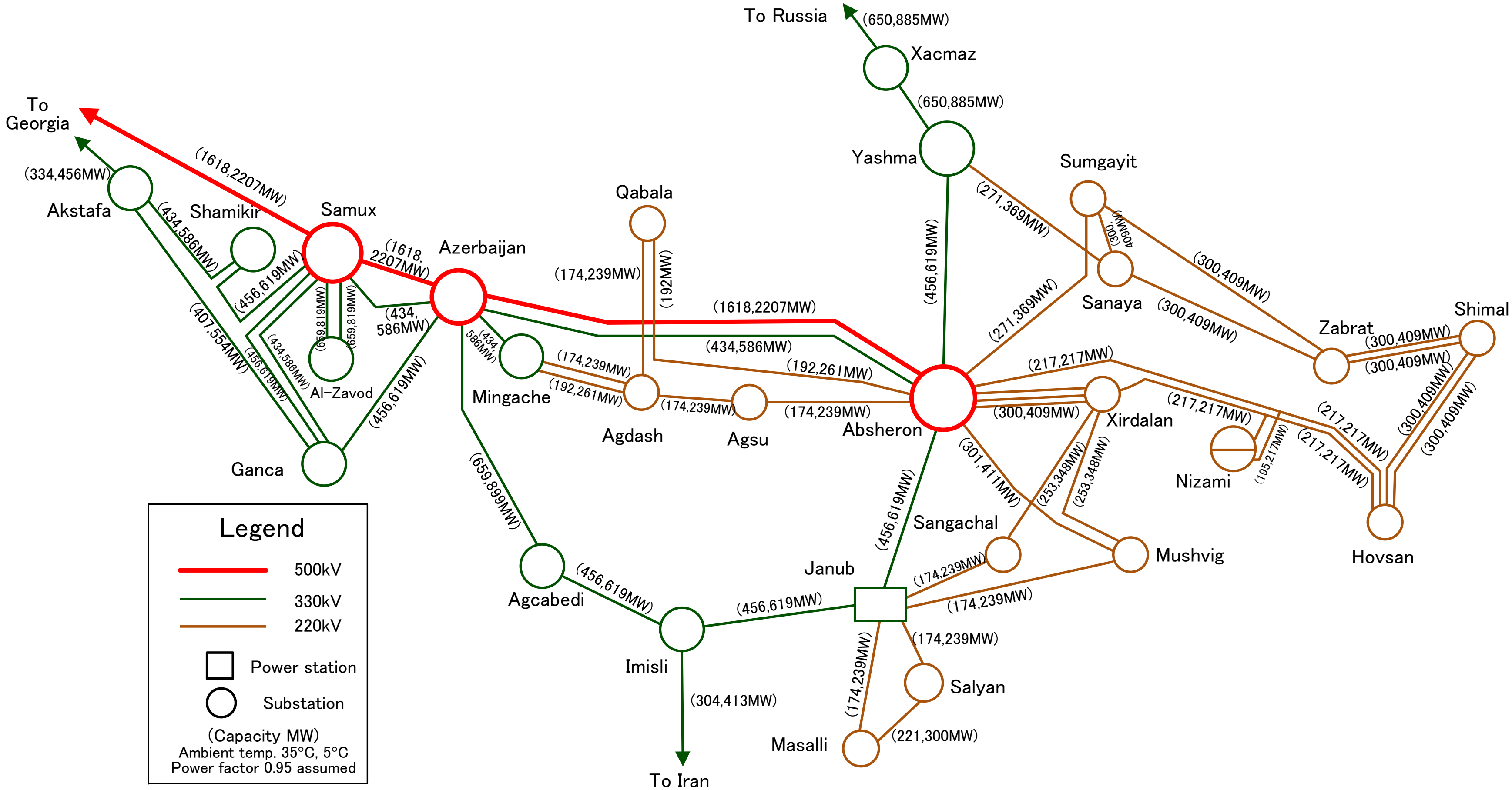
Figure 7.1-5 shows network configuration and transmitting capacities. 500kV and 330kV lines function to mutually interconnect between areas. 500kV lines have a transmitting capacity of 1,618MW or 2,207MW (ambient temperature 35°C, 5°C respectively) (power factor 0.95 assumed), and 330kV lines have a transmitting capacity of min.407-max.650MW (35°C) or 554-885MW (5°C). And 220kV lines have a transmitting capacity of 174-300MW (35°C) or 239-409MW (5°C).

By comparison, since the typical capacity of a 500kV line configured by Tokyo Electric Power Company (TEPCO) in Japan is 5,071MW (ambient temperature 40°C), capacity in Japan is 3.1 times Azerbaijan's. Azerenerji JSC's transmission capacity can therefore be considered very small.

This is because the transmission lines have conductors with a relatively small diameter, and the permissible highest temperature of the conductor is very low compared to TEPCO's 180°C.

Since the scale of present network is relatively small, overloading is not an issue.

That said, in the future, if demand increases and power flows in the lines increase, overloading problem will possibly come up, therefore, it will likely be necessary to upgrade transmitting capacity.



Source: JSCA

Figure 7.1-5 Network Configuration and Transmitting Capacities

2) Power Flow

Results of a power flow analysis using 2014 network data provided from Azerenerji JSC is shown in Figure 7.1-6, and power flows on major transmission lines are shown in Table 7.1-2. Hereafter, transmitting capacities in summer are selected as severe condition, the transmitting capacities in winter are about 1.36 times. The largest power flows are 351MW on the 500kV Azerbaijan-Absheron line (transmitting capacity defined by transmission line 1,618MW, defined by transformer 801MW), 339MW (transmitting capacity 659MW) on the 330kV Azerbaijan-Agcabedil line and 188MW (transmitting capacity 300MW) on the 220kV Sanaya-Sumgayit line. All of the power flows are much smaller than the transmitting capacities, and almost all utilization rates (=power flow/capacity) are below 50%, hence, no problems such as overloading exist.

Table 7.1-2 Power Flows on Major Transmission Lines in Winter of 2014

Voltage	From	To	P: Power flow (MW)	C: Capacity* (MW)	P/C: Utilization rate (%)
500kV	Samux	Azerbaijan	87	1,618	5
	Azerbaijan	Absheron	351	1,618 [801]	22 [44]
330kV	Samux	Shamikir	39	456	9
	Azerbaijan	Absheron	192	434	44
	Azerbaijan	Agcabedi	339	659	51
	Absheron	Yashma	150	456	33
220kV	Agdash	Agsu	92	174	53
	Janub	Mushvig	105	174	60
	Absheron	Xirdalan	122	300	41
	Xirdalan	Nizami	67	217	31
	Sanaya	Sumgayit	188	300	63
	Shimal	Zabrat	56	300	19
	Shimal	Govsan	40	300	13

*:Capacity in summer; winter capacity is 1.36 times [ ]:Defined by transformer capacity
In addition, capacity defined by stability also exists
Source: Power flow analysis result by the JICA Study Team using digital network analysis data provided from JSCA

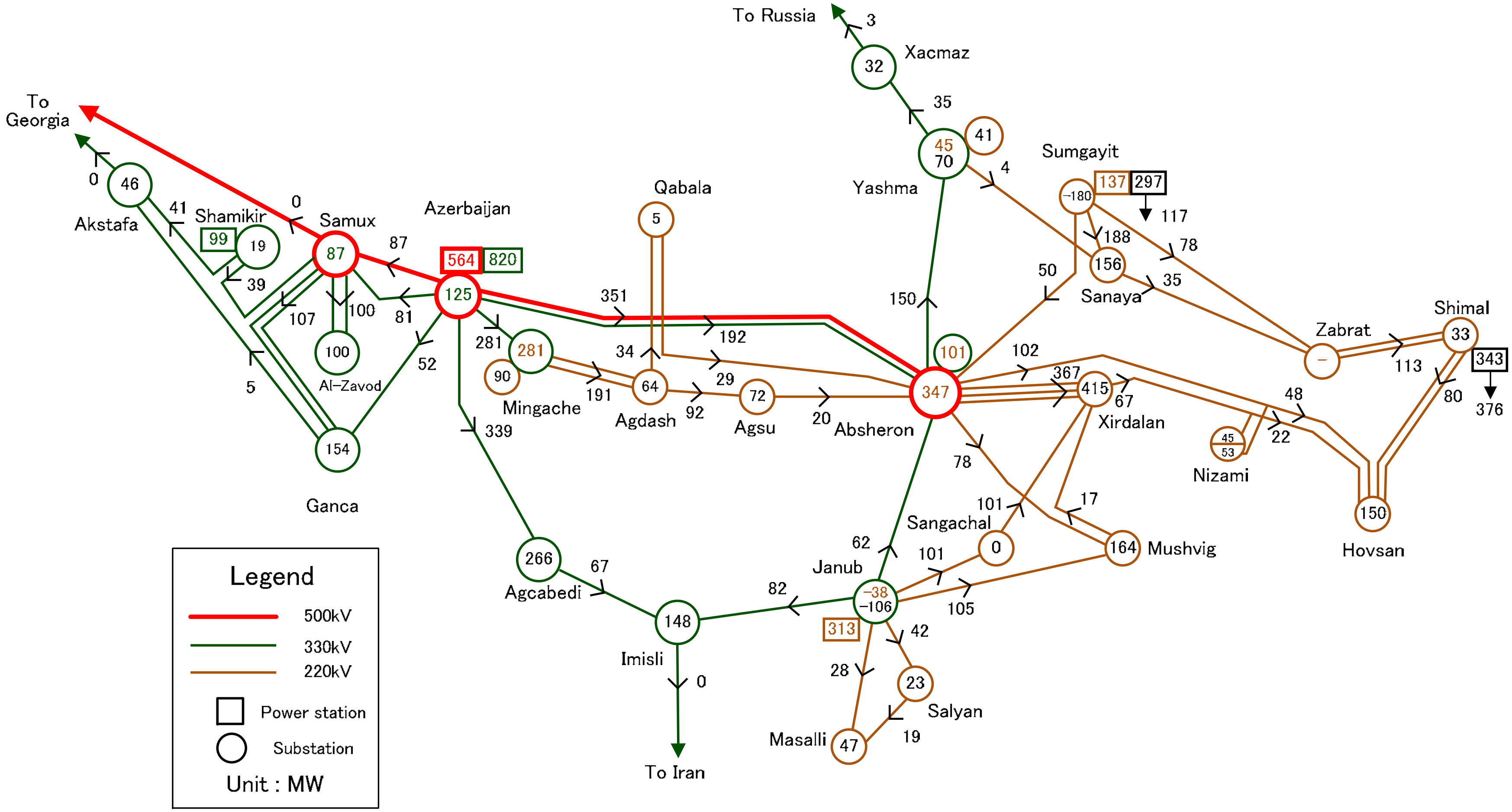
3) Fault Currents

Figure 7.1-7 and Table 7.1-3 show the result of fault current analysis. The largest fault currents on the 500kV, 330kV and 220kV networks are 9.7kA at Azerbaijan, 17.2kA at Azerbaijan and 19.8kA at Absheron, respectively. The maximum permissible currents are 63kA on the 500kV, and 40kA on the 330kV and 220kV. Hence, there is significant excess capacity between the fault currents and the maximum permissible currents, and no problems such as overcurrent exist.

Table 7.1-3 Fault Currents in 2014

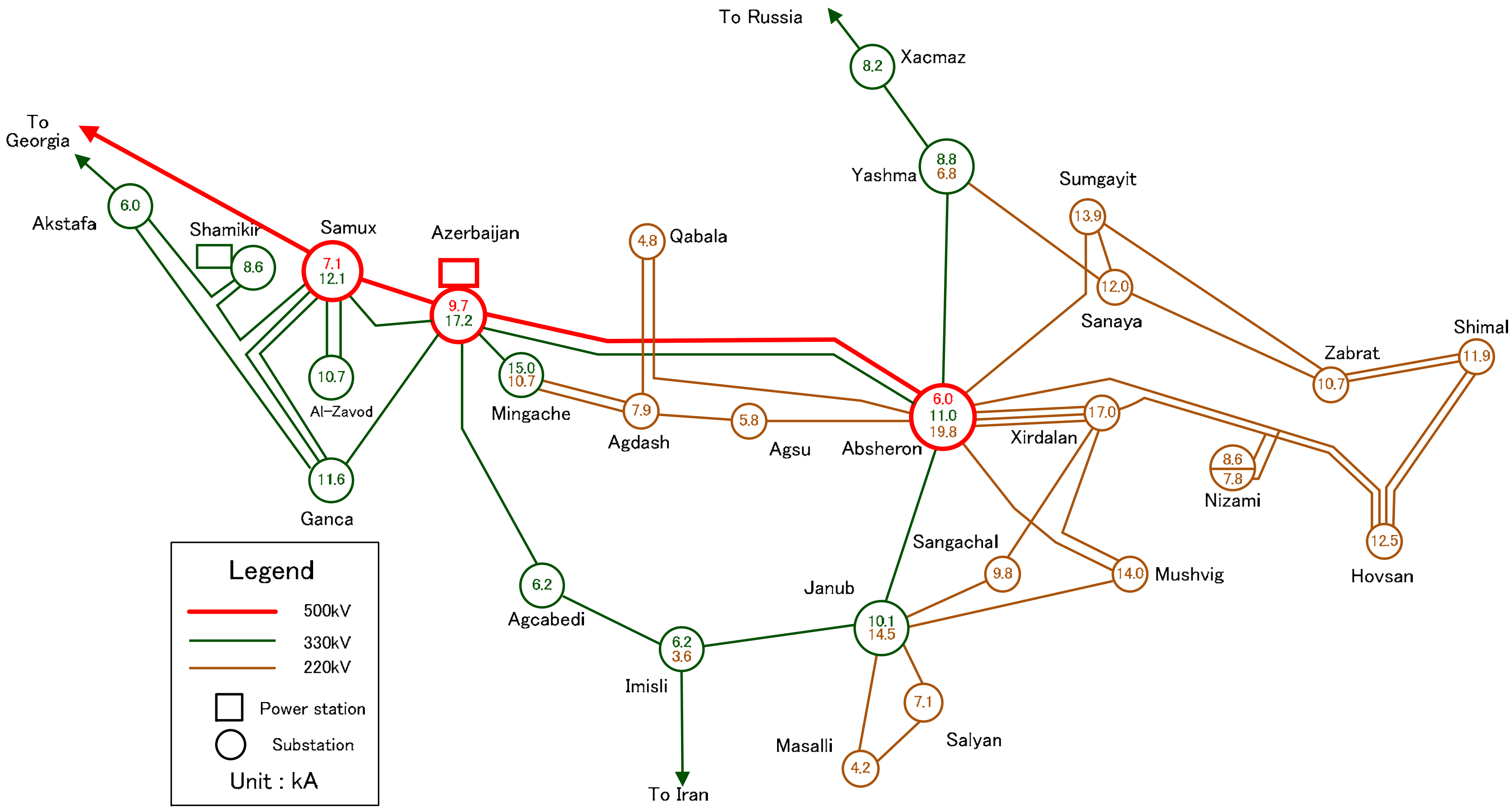
	Station	Short circuit current (kA)	Max. permissible current (kA)
500kV	Azerbaijan	9.7	63
	Samux	7.1	63
	Absheron	6.0	63
330kV	Azerbaijan	17.2	40
	Mingache	15.0	40
	Samux	12.1	40
	Absheron	11.0	40
220kV	Absheron	19.8	40
	Xirdalan	17.0	40
	Janub	14.5	40
	Sumgayit	13.9	40

Source: Power flow analysis result by JICA Study Team using digital network analysis data provided from JSCA



Source: Power flow analysis result by JICA Study Team using digital network analysis data provided from JSCA

Figure 7.1-6 Power Flows in Winter of 2014



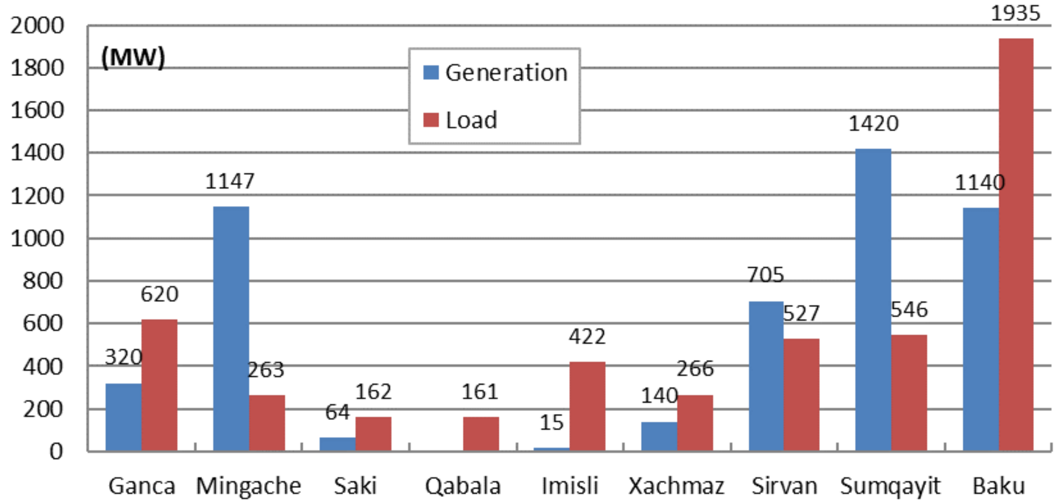
Source: Fault current analysis result by JICA Study Team using digital network analysis data provided from JSCA

Figure 7.1-7 Fault Currents in 2014

7.1.2 Network System for Yashma Gas Combined Cycle Power Plant

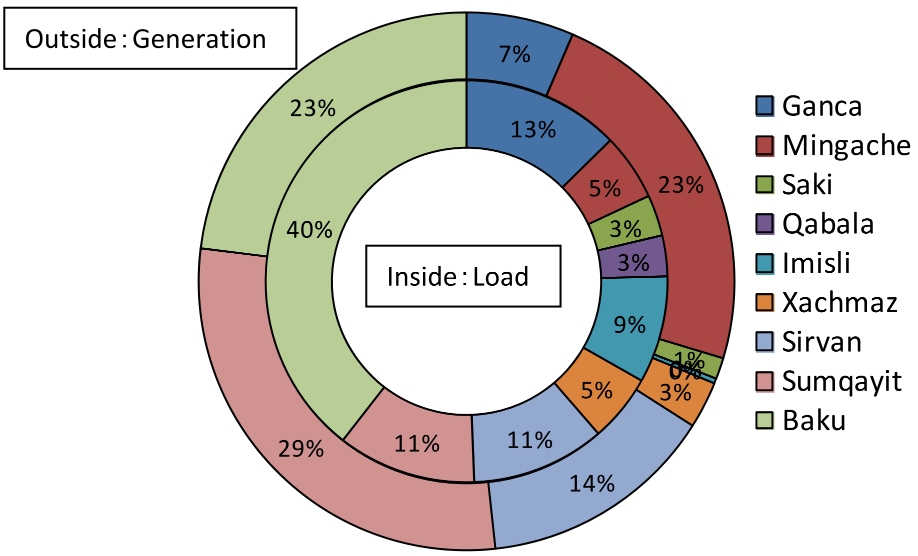
(1) Geographical Distribution of Load and Generation in 2018

The Yashma Gas Combined Cycle Power Plant (hereafter Yashma CCPP) is scheduled to be completed in 2018, and the geographical distribution of load and generation following its completion is analyzed using data for the 2018 winter peak provided by Azerenerji JSC. The results are shown in Figure 7.1-8 and Figure 7.1-9.



Source: Network analysis data provided by JSCA

Figure 7.1-8 Distribution Chart of Load and Generation as of 2018



Source: Network analysis data provided by JSCA

Figure 7.1-9 Percentage Breakdown by Area of Load and Generation as of 2018

The percentage breakdown of the total load of 4,901MW at the winter peak is as follows.
Ganca: 13%, Mingache: 5%, Saki: 3%, Qabala: 3%, Imisli: 9%, Xachmaz: 5%, Sirvan: 11%, Sumgayit: 11% and Baku: 40%
Meanwhile, the percentage of the total generation of 4,950MW is as follows.
Ganca: 7%, Mingache: 23%, Saki: 1%, Qabala: 0%, Imisli: 0%, Xachmaz: 3%, Sirvan: 14%, Sumgayit: 29% and Baku: 23%
Comparing these values to those in 2014 described in Chapter 7.1.1 (2), it can be said that the development of the Yashma CCPP with a large total output of 920MW in the Sumgayit area near Baku will improve network characteristics because the need to transmit a significant power over a long distance from the Azerbaijan Power Station will disappear.

(2) Technical Standards and Study Conditions

Azerenerji JSC's network planning criteria[1] are referred to for the evaluation of the network analysis results obtained in the study.

1) Power Flow
- Under normal operation conditions, the power flow shall be within the allowable capacity of the transmission lines.
- Under single contingency conditions (so-called N-1), the power flow of the remaining transmission lines shall not exceed 120% of the allowable capacity of the transmission lines.
- N-2 (double contingency) criteria shall be fulfilled for the system in large cities such as Baku.
- N-1 criteria shall be fulfilled for the system in other areas.

2) Fault Current
The fault current shall not exceed the values in Table 7.1-4.

Table 7.1-4 Maximum Fault Current

Voltage (kV)	110-150	220-330	500-750
Fault Current (kA)	31.5	40	63

3) System Stability
The conditions of the system stability analysis were set as follows:
- The power system stability shall be maintained without suppression of outputs of primal generators and/or power outages under the following fault conditions:
  - three-phase short-circuit fault of single circuit of a certain transmission line
  - fault clearing by primary protection
  - no automatic reclosing of the transmission line at fault
- The fault clearing time of the primary protection relay is shown in Table 7.1-5.

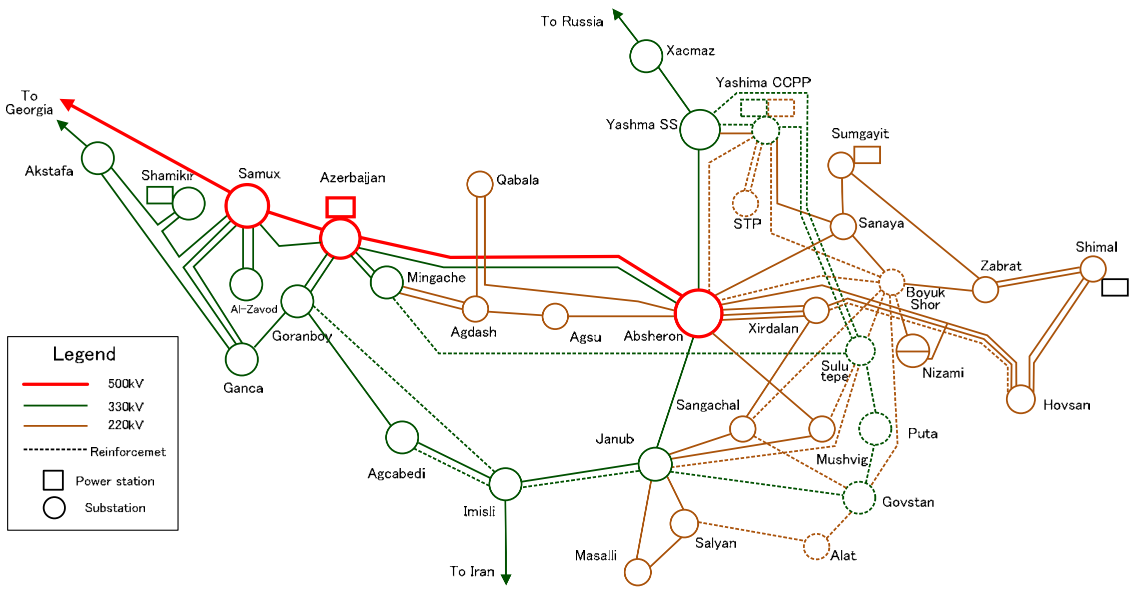
[1] Azerenerji's system planning criteria is based on the publication "GUIDE FOR DESIGN OF ELECTRICAL NETWORKS", Edited DL Faibisovich. - Moscow: Publishing House of the NTs ENAS 2006

Table 7.1-5 Fault Clearing Time of Primary Protection Relay

Voltage class (kV)	Clearing time (ms)
500	120
330	140
220	160

(3) Azerenerji JSC's Planned Network

Azerenerji JSC has a plan to reinforce the network because of an anticipated demand increase from 3,850MW in 2014 to 4,850MW in 2018. One unit at the Yashma CCPP will be connected to the 330kV network and another unit to the 220kV network.
Figure 7.1-10 shows Azerenerji JSC's network reinforcement, with the facilities to be reinforced represented by the dotted line. Note that because of the development of the Yashma CCPP, many lines around the Yashma CCPP will be developed to transmit the power. The Yashma CCPP will be interconnected to 2 of the 330kV lines and 4 of the 220kV lines (2 lines to STP Substation are excluded, because the purpose of these lines is to supply power to the particular substation).



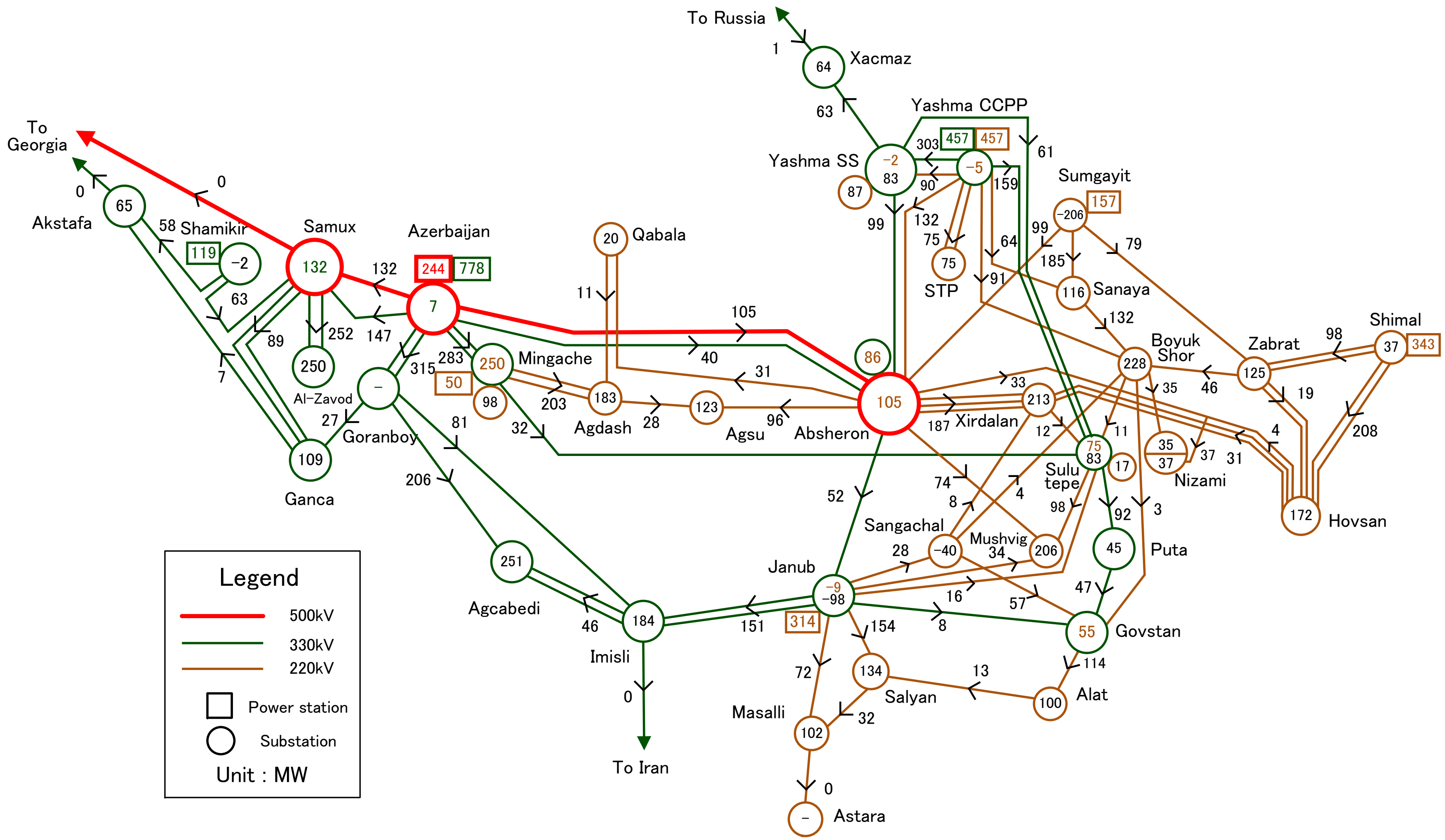
Source: Network analysis data provided by JSCA

Figure 7.1-10 Azerenerji JSC's Network Reinforcement

1) Power Flow

a) Under normal condition

Figure 7.1-11 shows the power flow under normal operating conditions for Azerenerji JSC's planned network at the 2018 winter peak (power flows around the Yashma CCPP are shown in Table 7.1-6).
All of the power flows are below half of actual capacities and therefore no overloading problems exist.



Source: Power flow analysis result by JICA Study Team using digital network analysis data provided from JSCA

Figure 7.1-11 Power Flows of Azerenerji JSC's Planned Network in 2018

Table 7.1-6 Power Flows around the Yashma CCPP under Normal Operating Conditions

Voltage	Transmission line		Power flow (MW)	Capacity (MW)	Remarks
	From	To			
330kV	Yashma CCPP	Yashma SS	303	650*	
	Yashma CCPP	Sulu Tepe	159	650*	
	Yashma SS	Sulu Tepe	61	650*	
	Yashma SS	Absheron	99	456	
220kV	Yashma CCPP	Yashma SS	90	271	
	Yashma CCPP	Absheron	132	300*	
	Yashma CCPP	Boyuk Shor	91	300*	
	Yashma CCPP	Sanaya	64	271	

(*): Capacity is assumed by maximum capacity of existing lines, because of planned lines
Source: Power flow analysis result by JICA Study Team using digital network analysis data provided from JSCA

b) Under contingency condition

Table 7.1-7 shows power flows around the Yashma CCPP under certain contingency conditions. Transmission capacities are expressed relative to the contingency condition, which is 1.2 times that of normal operating capacity.

Since the Yashma CCPP is connected to many lines – to 2 of the 330kV lines and to 4 of the 220kV lines (2 lines to STP Substation are excluded, because the purpose of these lines is to supply power to the particular substation) - no overloading occurs on any line under the N-1 condition or even under the severe N-2 condition. There is sufficient allowance against transmitting capacity.

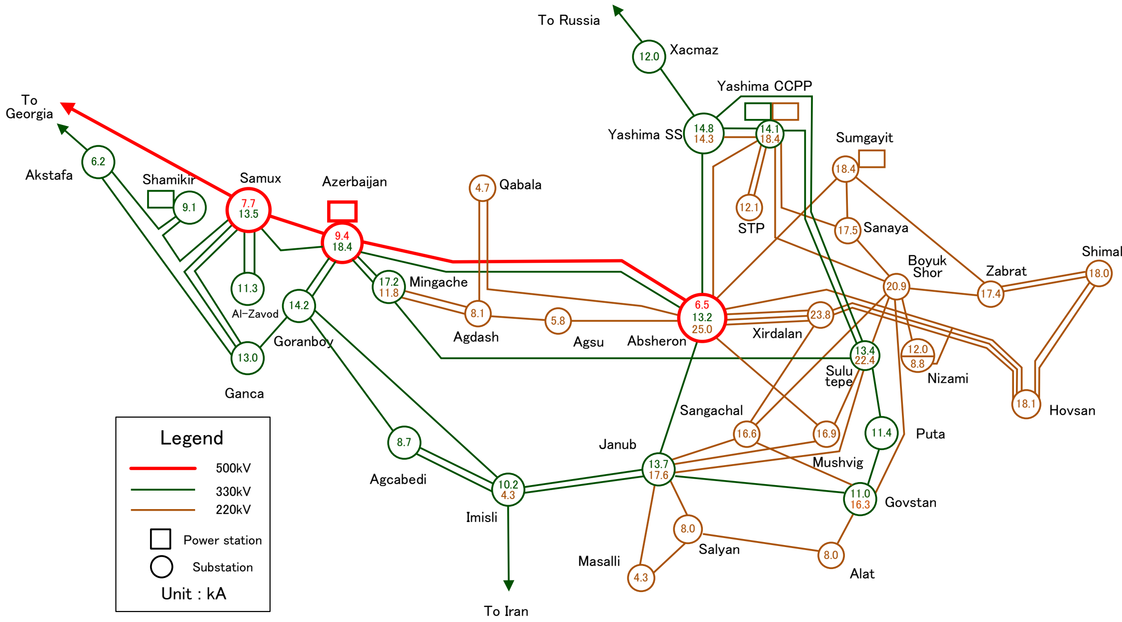
Table 7.1-7 Power Flows around the Yashma CCPP under Contingency Condition Unit: MW

Voltage		330kV				220kV			
Line		YaP-YaS	YaP-SuT	YaS-SuT	YaS-Abs	YaP-YaS	YaP-Abs	YaP-Boy	YaP-San
Capacity* (MW) (N-1,N-2 condition)		780	780	780	547	325	360	360	325
Before fault		303	159	61	99	90	132	91	64
N-1	Faulted line 330kV YaP - YaS	-	331	49	0	183	153	99	73
	330kV YaP - SuT	431	-	134	142	78	151	104	76
	330kV YaS - SuT	262	195	-	113	83	136	95	67
	220kV YaP - YaS	361	150	51	77	-	152	102	75
	220kV YaP - Abs	323	183	72	137	119	-	119	96
	220kV YaP - Boy	310	174	68	113	104	161	-	90
	220kV YaP - San	308	65	169	109	100	154	108	-
N-2	330kV YaP - YaS, 330kV YaP - SuT	-	-	54	8	290	262	155	132
	330kV YaP - YaS, 330kV YaS - SuT	-	317	-	29	203	151	97	72
	330kV YaP – SuT, 330kV YaS - SuT	395	-	-	216	52	179	121	93
	330kV YaP - YaS, 220kV YaP - YaS	-	391	127	102	-	216	128	104
	330kV YaP - YaS, 220kV YaP - Abs	-	372	44	37	224	-	132	111
	330kV YaP - YaS, 220kV YaP - Boy	-	351	43	14	201	186	-	101
	330kV YaP - YaS, 220kV YaP - San	-	346	45	11	197	179	118	-
	330kV YaP – SuT, 220kV YaP - YaS	475	-	121	121	-	168	112	85
	330kV YaP – SuT, 220kV YaP - Abs	476	-	160	195	110	-	138	115
	330kV YaP – SuT, 220kV YaP - Boy	452	-	151	164	93	187	-	106
	330kV YaP – SuT, 220kV YaP - San	446	-	145	159	89	179	124	-
	220kV YaP – YaS, 220kV YaP - Abs	408	175	60	115	-	-	139	118
	220kV YaP – YaS, 220kV YaP - Boy	379	165	57	90	-	190	-	105
	220kV YaP – YaS, 220kV YaP - San	375	160	55	87	-	181	122	-
	220kV YaP – Abs, 220kV YaP - Boy	338	212	86	169	149	-	-	141
	220kV YaP – Abs, 220kV YaP - San	337	206	82	165	144	-	153	-
	220kV YaP – Boy, 220kV YaP - San	320	193	77	134	124	203	-	-

*:Capacity in summer:winter capacity is 1.36 times YaP: Yashma CCPP, YaS: Yashma SS, SuT: Sulu Tepe, Abs: Absheron, Boy: Boyuk Shor, San: Sanaya
Source: Power flow analysis result by JICA Study Team using digital network analysis data provided from JSCA

2) Fault current

Figure 7.1-12 shows the fault current in Azerenerji JSC's planned network as of 2018. Maximum values in each voltage class are 9.4kA of 500kV at Azerbaijan SS, 18.4kA of 330kV at Azerbaijan SS and 25.0kA of 220kV at Absheron, and these values are greatly below the maximum permissible values of 63kA, 40kA and 40kA, respectively.



Source: Fault current analysis result by JICA Study Team using digital network analysis data provided from JSCA

Figure 7.1-12 Fault Current of Azerenerji JSC's Planned Network in 2018

3) Stability

The fault clearing time determined by the circuit breaker operating time is 120ms for 500kV, 140ms for 330kV and 160ms for 220kV. Therefore, the stability analysis was conducted under conditions whereby transients were initiated by three phase faults on the system. Since the circuit breaker will open the circuit in the above mentioned time, the faulted circuit will be isolated.

Regarding stability for the Yashma CCPP, a fault occurring near the power station is severe, hence the analysis is conducted mainly for scenarios where a fault occurs at the sending end of transmission lines connected to the Yashma CCPP and then the line is opened.

Table 7.1-8 shows the result of the stability analysis, and Figure 7.1-13 indicates the phase fluctuation curve of generator voltage.

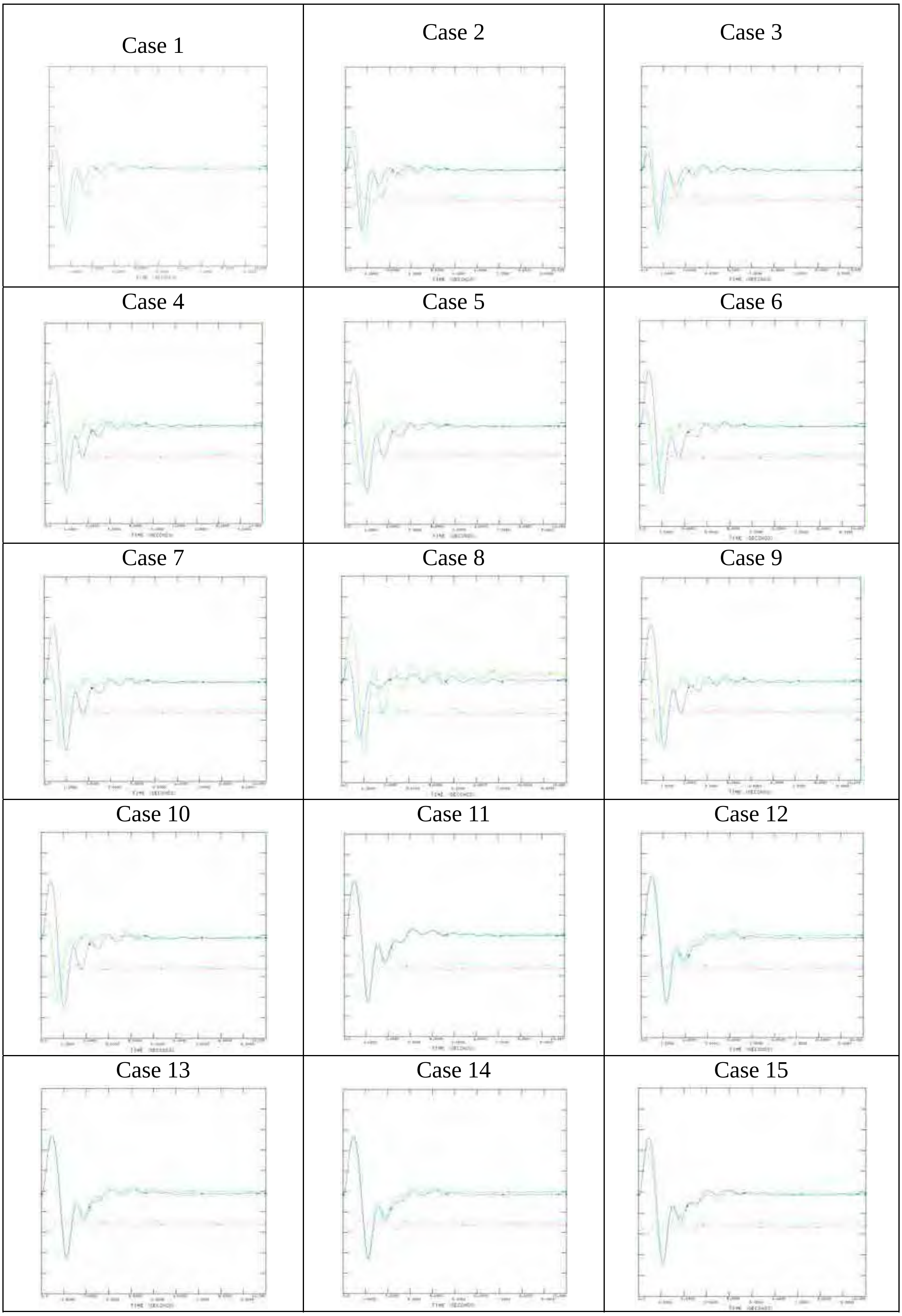
After operation of the circuit breaker and isolation of the faulted line, previous power flow on the said line is surcharged on the sound line. It turns out that in every case shown in the table, the phase fluctuation curves of generator voltage appear to attenuate and converge with time, and the system appears to remain stable even under the N-2 condition because the Yashma CCPP is connected by many lines and the power flow before a fault is relatively small.

Figure 7.1-14 and Figure 7.1-15 show the generator angle fluctuation, voltage fluctuation and frequency fluctuation for Case8 and Case11 which are the most severe cases of N-2 condition.

Table 7.1-8 Stability Analysis Result

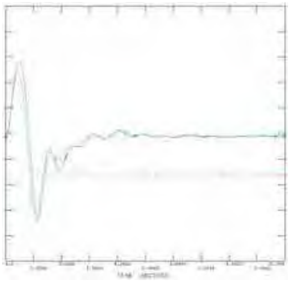
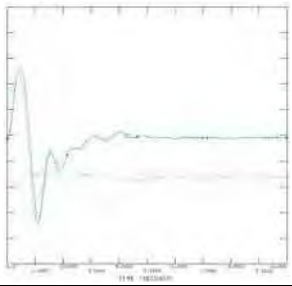
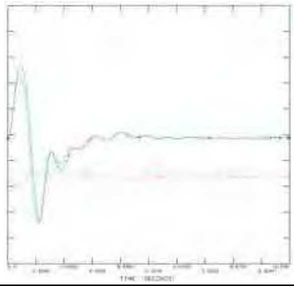
Network : Azerenerji JSC's Planned Network				
Contin-gency	Faulted Point	Tripped Line	Result	Case
N-1	Near 330kV bus of Yashma CCPP	330kV Yashma CCPP-Yashma SS	Stable	1
		330kV Yashma CCPP-Sulu Tepe	Stable	2
		330kV Yashma SS-Sulu Tepe	Stable	3
	Near 220kV bus of Yashma CCPP	220kV Yashma CCPP- Yashma SS	Stable	4
		220kV Yashma CCPP-Absheron	Stable	5
		220kV Yashma CCPP-Boyuk Shor	Stable	6
		220kV Yashma CCPP-Sanaya	Stable	7
N-2	Near 330kV bus of Yashma CCPP	330kV Yashma CCPP-Yashma SS 330kV Yashma SS-Sulu Tepe	Stable	8
	Near 220kV bus of Yashma CCPP	220kV Yashma CCPP- Yashma SS 220kV Yashma CCPP-Absheron	Stable	9
		220kV Yashma CCPP-Boyuk Shor 220kV Yashma CCPP-Sanaya	Stable	10
	Near 330kV bus of Yashma CCPP Near 220kV bus of Yashma CCPP	330kV Yashma CCPP-Yashma SS 220kV Yashma CCPP- Yashma SS	Stable	11
		330kV Yashma CCPP-Yashma SS 220kV Yashma CCPP-Absheron	Stable	12
		330kV Yashma CCPP-Yashma SS 220kV Yashma CCPP-Boyuk Shor	Stable	13
		330kV Yashma CCPP-Yashma SS 220kV Yashma CCPP-Sanaya	Stable	14
		330kV Yashma CCPP-Sulu Tepe 220kV Yashma CCPP- Yashma SS	Stable	15
		330kV Yashma CCPP-Sulu Tepe 220kV Yashma CCPP-Absheron	Stable	16
		330kV Yashma CCPP-Sulu Tepe 220kV Yashma CCPP-Boyuk Shor	Stable	17
		330kV Yashma CCPP-Sulu Tepe 220kV Yashma CCPP-Sanaya	Stable	18

Source: Stability analysis result by JICA Study Team using digital network analysis data provided from JSCA



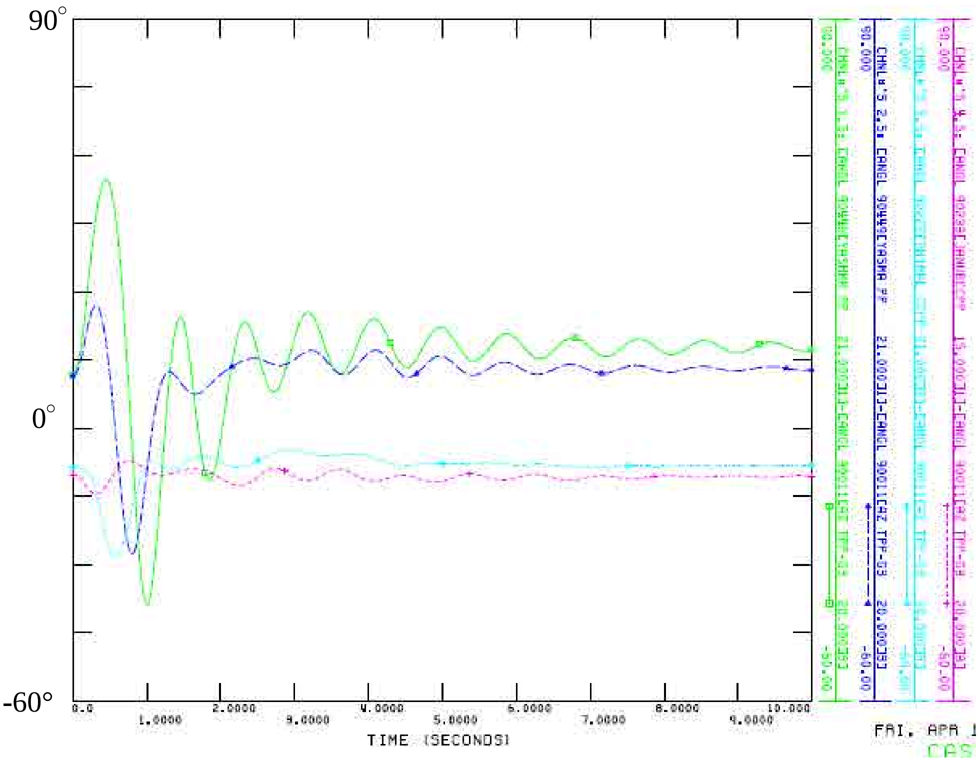
Source: Stability analysis result by JICA Study Team using digital network analysis data provided from JSCA

Figure 7.1-13(1) Phase Fluctuation Curve of Generator Voltage

Case 16	Case 17	Case 18
		

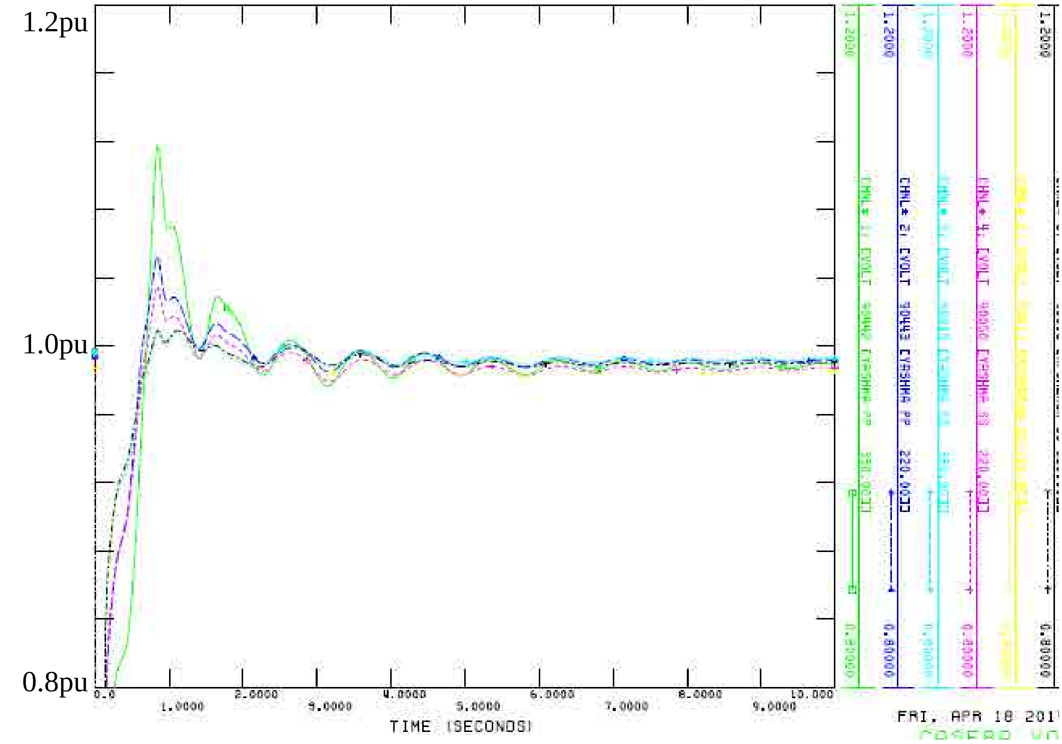
Source: Stability analysis result by JICA Study Team using digital network analysis data provided from JSCA

Figure 7.1-13(2) Phase Fluctuation Curve of Generator Voltage



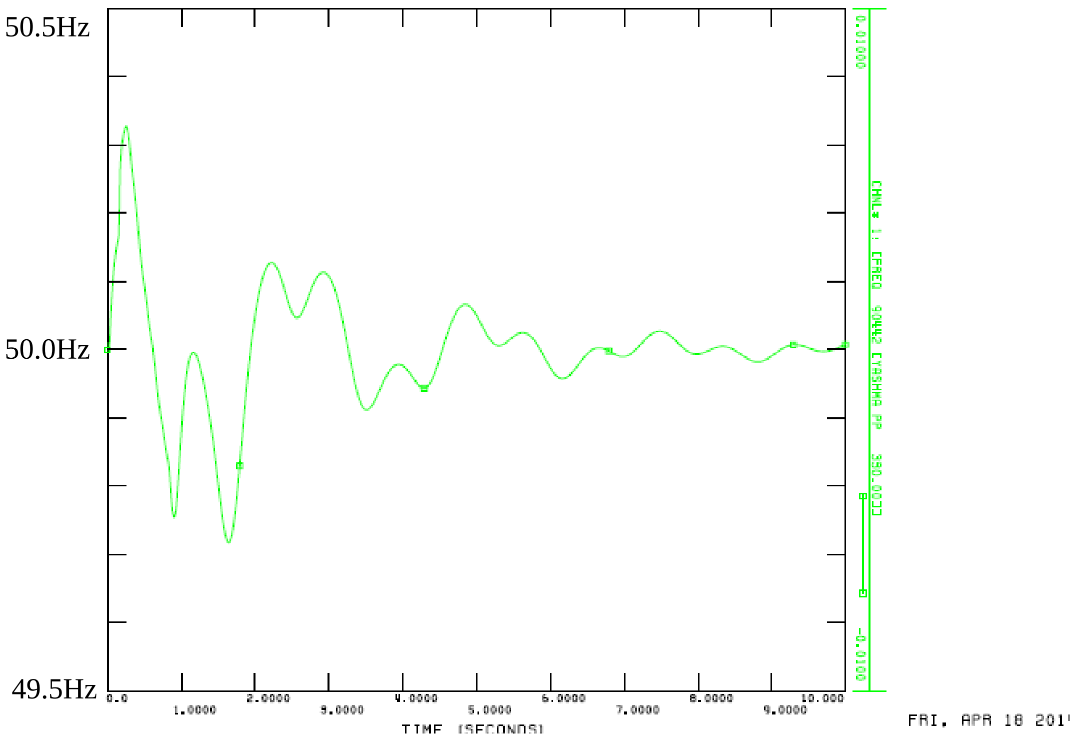
Source: Stability analysis result by JICA Study Team using digital network analysis data provided by JSCA

Figure 7.1-14(1) Phase Fluctuation Curve of Generator Voltage of Case8



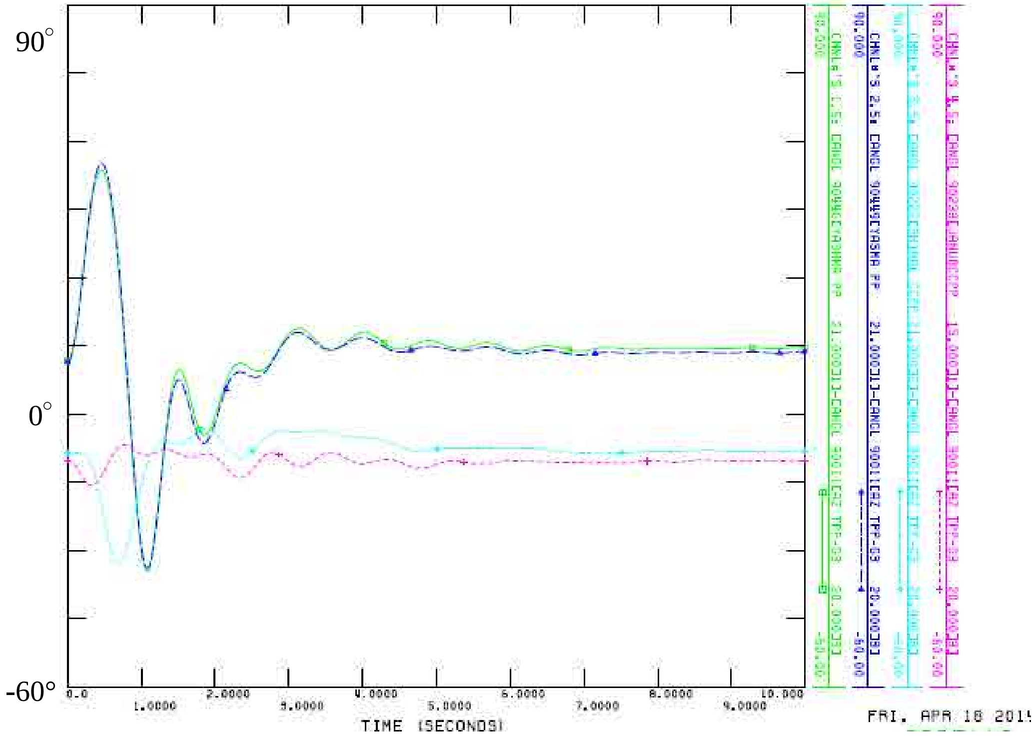
Source: Stability analysis result by JICA Study Team using digital network analysis data provided by JSCA

Figure 7.1-14(2) Voltage Fluctuation Curve of Case8



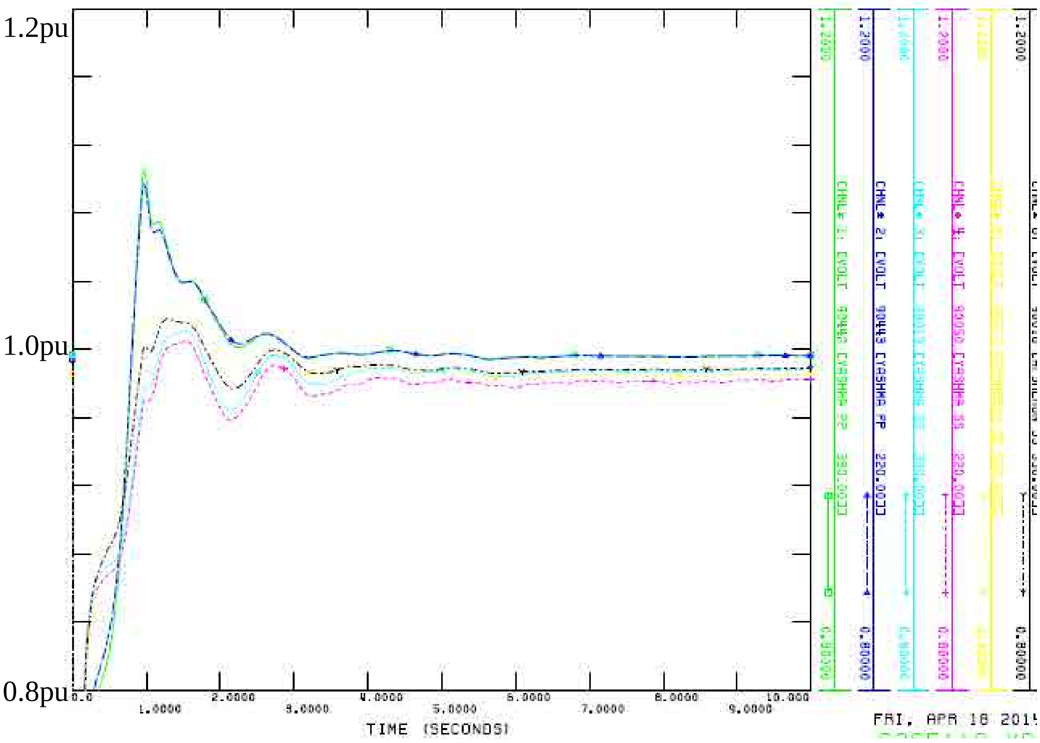
Source: Stability analysis result by JICA Study Team using digital network analysis data provided by JSCA

Figure 7.1-14(3) Frequency Fluctuation Curve of Case8



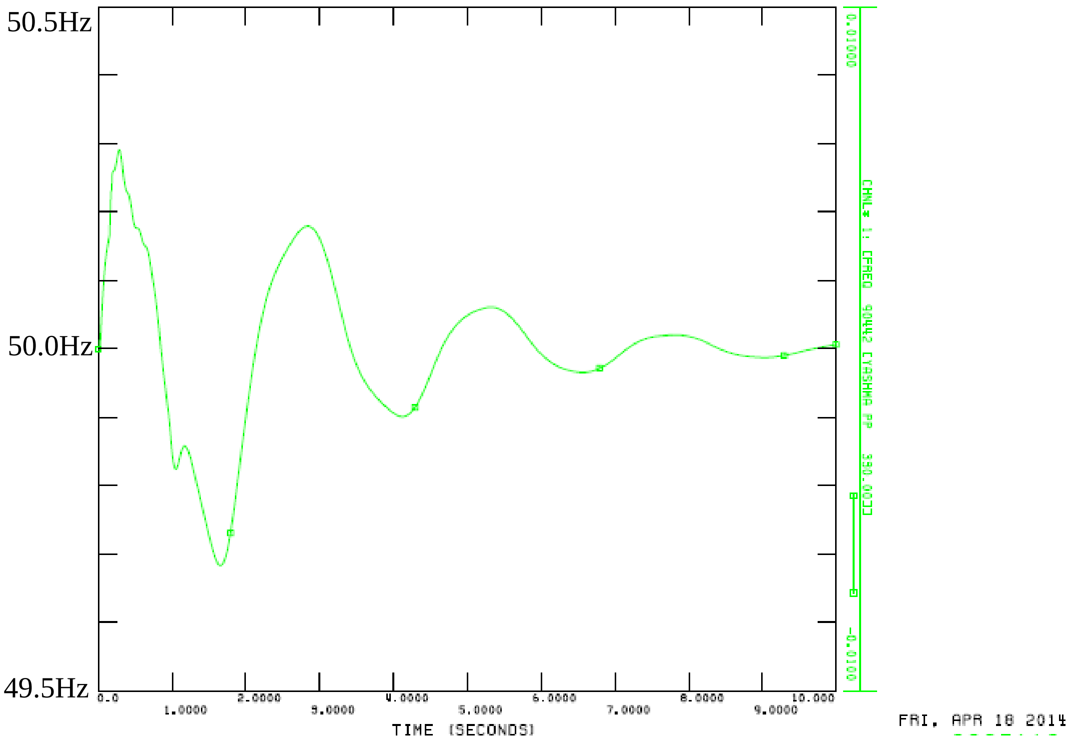
Source: Stability analysis result by JICA Study Team using digital network analysis data provided by JSCA

Figure 7.1-15(1) Phase Fluctuation Curve of Generator Voltage of Case11



Source: Stability analysis result by JICA Study Team using digital network analysis data provided by JSCA

Figure 7.1-15(2) Voltage Fluctuation Curve of Case11



Source: Stability analysis result by JICA Study Team using digital network analysis data provided from JSCA

Figure 7.1-15(3) Frequency Fluctuation Curve of Case11

7.1.3 Measures for Stable Network Operation

(1) Present issues facing Azerenerji JSC network

Since the Azerenerji JSC network is configured using many transmission lines to satisfy severe power supply criteria, it can be said that it is robust against normal contingency conditions such as fault occurrence in transmission lines.

Moreover, under normal operation conditions, Azerenerji JSC network is interconnected to the Russian network through a 330kV single circuit line. The total interconnected network capacity is enormous, and as a result, the stable network operation can be maintained.

However, once the interconnecting line is opened, the network capacity is not so large to maintain stable network operation.

(2) Present measures of Azerenerji JSC

Under normal conditions, both Azerenerji JSC and Russian networks balance the demand with the supply to make the power flow in an interconnecting line reaching almost zero.

If a generator shutdown occurs in one network and the power flow increases in the interconnecting line, load is shed in a multiple-stage procedure to keep the power flow in the interconnecting line almost at zero as shown in Table 7.1-9.

If the power flow in the line cannot be kept close to zero in spite of this procedure, the interconnecting line will be opened. After this procedure is implemented and Azerenerji JSC's network is isolated from the Russian network, load shedding is continued to balance demand with supply in multiple-stage procedures as shown in Table 7.1-10. If these operations work well and a normal frequency maintained for a certain period of time, the power supply will be restituted.

Table 7.1-9 Procedure in Case of Power Flow Increase in Interconnecting Line

Power flow from Russia to Azerenerji JSC	Duration time	Load shed	
80MW	0.1s	100MW	
150MW	0.1s	200MW	
200MW	0.1s	250MW	
250MW	0.1s	300MW	
300MW	0.1s	350MW	
380MW	0.1s	400MW	

Source: JSCA

Table 7.1-10 Load Shedding and Restitution

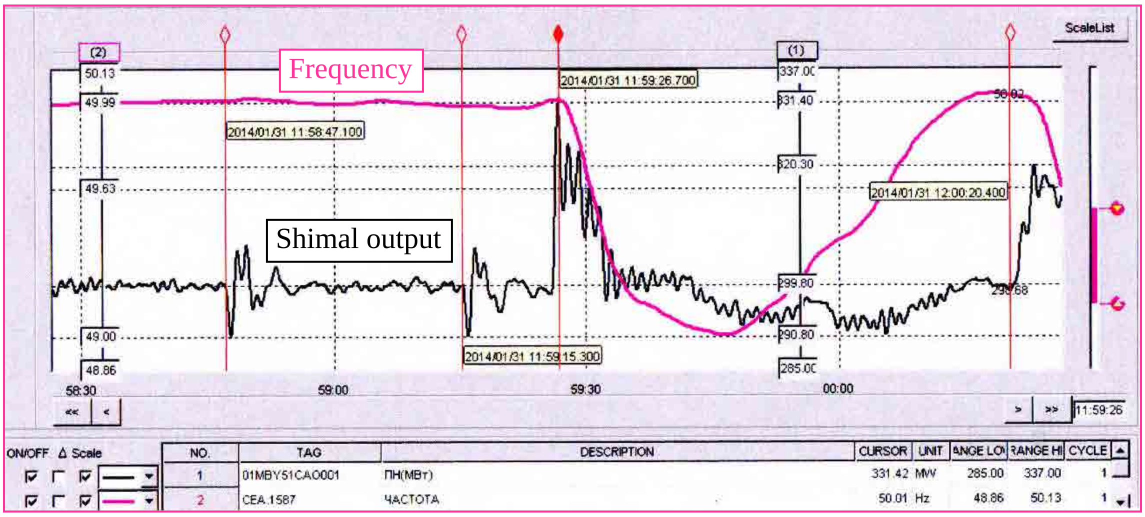
Step	Short time change		Long time change		Load shed (MW)	Restitution	
	Frequency (Hz)	Duration time (s)	Frequency (Hz)	Duration time (s)		Frequency (Hz)	Duration time (s)
1	48.8	0.2	49.0	5	159.2	49.8	45-60
	48.8	0.2	49.0	10		49.8	50-60
	48.8	0.2	49.0	15		49.8	60
2	48.6	0.2	49.0	15	163.9	49.6/49.7	65-75
	48.6	0.2	49.0	20		49.7	70
	48.6	0.2	48.9	20		49.6/49.8	25-70
3	48.4	0.2	48.9	25	160.0	49.6	45-65
	48.4	0.2	48.9	30		49.7	65-70
4	48.2	0.2	48.9	30	155.7	49.6	55-60
	48.2	0.2	48.9	30		49.7	40/65-70
	48.2	0.2	48.9	35		49.7	65
5	48.0	0.2	48.9	35	153.0	49.7/49.8	35/40
	48.0	0.2	48.8	35		49.6	30
	48.0	0.2	48.8	35		49.7	35/75
6	47.8	0.2	48.8	35	165.3	49.7/49.8	60/70
	47.8	0.2	48.8	40		49.7	35-75
7	47.6	0.2	48.8	40	143	49.6/49.7	40/30
	47.6	0.2	48.8	45		49.6/49.7	45/20-45
8	47.4	0.2	48.8	45	152.1	49.6/49.7	35-65/10-40
	47.4	0.2	48.8	50		49.6	35-50
9	47.2	0.2	48.8	50	160.7	49.6/49.7	35-40/20
	47.2	0.2	48.7	50		49.6/49.7	20-30/30-40
10	47.0	0.2	48.7	50	168.4	49.6	10
	47.0	0.2	48.7	55		49.6/49.8	20/30
11	46.8	0.2	48.7	60	136..0	49.7	25
	46.8	0.2	48.7	60		49.5/49.6	10/10-45
12	46.6	0.2	48.7	65	151.0	49.5	10-30
	46.6	0.2	48.7	65		49.7	10

Source: JSCA

(3) Example of maintaining network stability with the UFR system

The gas compressor had a breakdown on 31st January 2014, the total demand was 2,300MW. As a consequence, Janub PP, with an output of 650MW, was tripped because of no fuel supply.

Figure 7.1-16 shows the frequency and power swing at that time.
Immediately after the plant shutdown and power flow increase in the interconnection line from Russia, the line was opened, the Azerenerji JSC network was isolated, and the load was shed appropriately one after another by the UFR system. Although the frequency dropped briefly to 49Hz because 28% of total generation was lost, this scheme worked well, and Shimal PP's generator was able to continue operating without tripping.



Source: JSCA

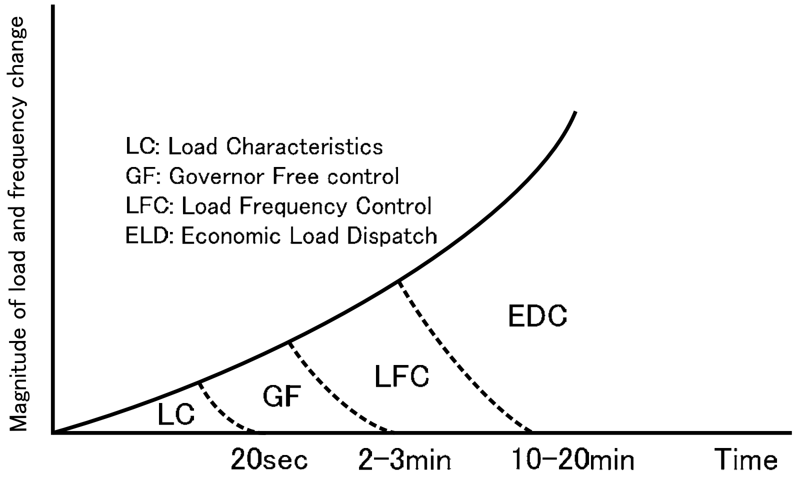
Figure 7.1-16 Frequency and Power Swing in the Case of a Tripped Janub PP

(4) Load frequency control

When the load and frequency change, depending on the time and magnitude of load and frequency change, several measures are taken to recover the frequency as shown in Figure 7.1-17.

Since the loads have frequency characteristics, that is, the loads decrease instantaneously in case of frequency drop, those characteristics are effective to maintain the frequency for about 20 seconds or less.

Governor-free generators which have margin to the governor limit can automatically control the output in response to a frequency change in the period of several seconds to several minutes.



Source: Study Team

Figure 7.1-17 Load Frequency Control

(5) Load Frequency Control Commonly-used in Japan

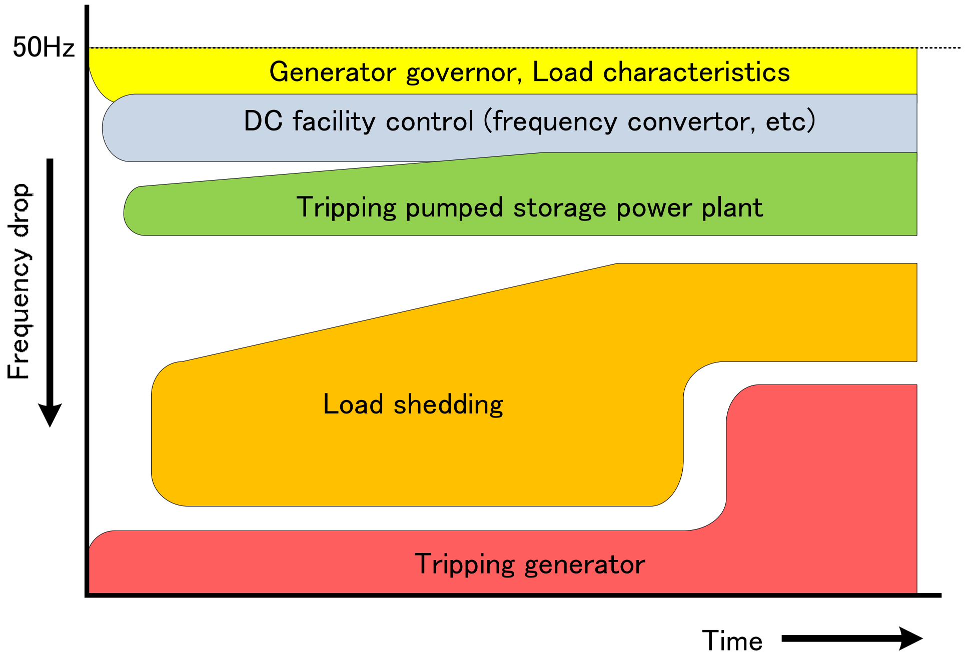
Figure 7.1-18 shows the frequency control commonly-used in Japan.

In a small frequency change range, the frequency is maintained by the load characteristics and the governor of generators.

The next step is to utilize a DC facility such as a frequency converter station which can control the power at high speed.

In case of a substantial frequency drop, tripping pumped storage power plant under pumping-up operation and/or shedding load are taken.

If the frequency cannot be recovered in spite of these measures, the generators are tripped to prevent damage by facility protection relays.



Source: Study Team

Figure 7.1-18 Frequency Controls Commonly-used in Japan

(6) Measures for stable network operation

The UFR system has been already utilized for the entire existing network by Azerenerji JSC, and at present the necessary governor-free generator capacity is ensured, but the measures for stable network operation will be important more than ever.

In order to improve the stability of the network in Azerbaijan, pursuit and analysis of the exact cause of past frequency drop and generator tripping are carried out first, and then upon reflection of these study results, adequate measures should be taken.

1) Measures when Yashma CCPP is connected to the network

- Fine-tuning UFR system, based on the cause investigation and demand-frequency characteristics of the network including Yashma CCPP.
- Ensuring enough governor-free generator capacity and spinning reserve capacity by utilizing allowance of reserve margin due to completion of Yashma CCPP.

2) Future measures

- Upgrading UFR system from present decentralized system to centralized control system.
- Introduction of islanding scheme to prevent wide-scale blackout.
- Introduction of hydropower plants of adequate proportion (about 20%) of total power development, because hydropower plants with governor generators can adjust the output at high speed
- Introduction of pumped storage power plant for off-peak spinning reserves
- Reinforcement of interconnection line to Russia network
- Introduction of System Stabilizing Controller (SSC)* for total network stability

*: In case of generator tripped, SSC determines the optimal load to be shed based on network characteristics.

7.2 Grid Connection Plan

7.2.1 Transmission Lines

Grid Connection Plan of transmission lines for the Yashma CCPP that are planned by Azerenerji JSC are shown in Figure 7.2-1. The actual transmission line route is shown in Figure 7.2-2.

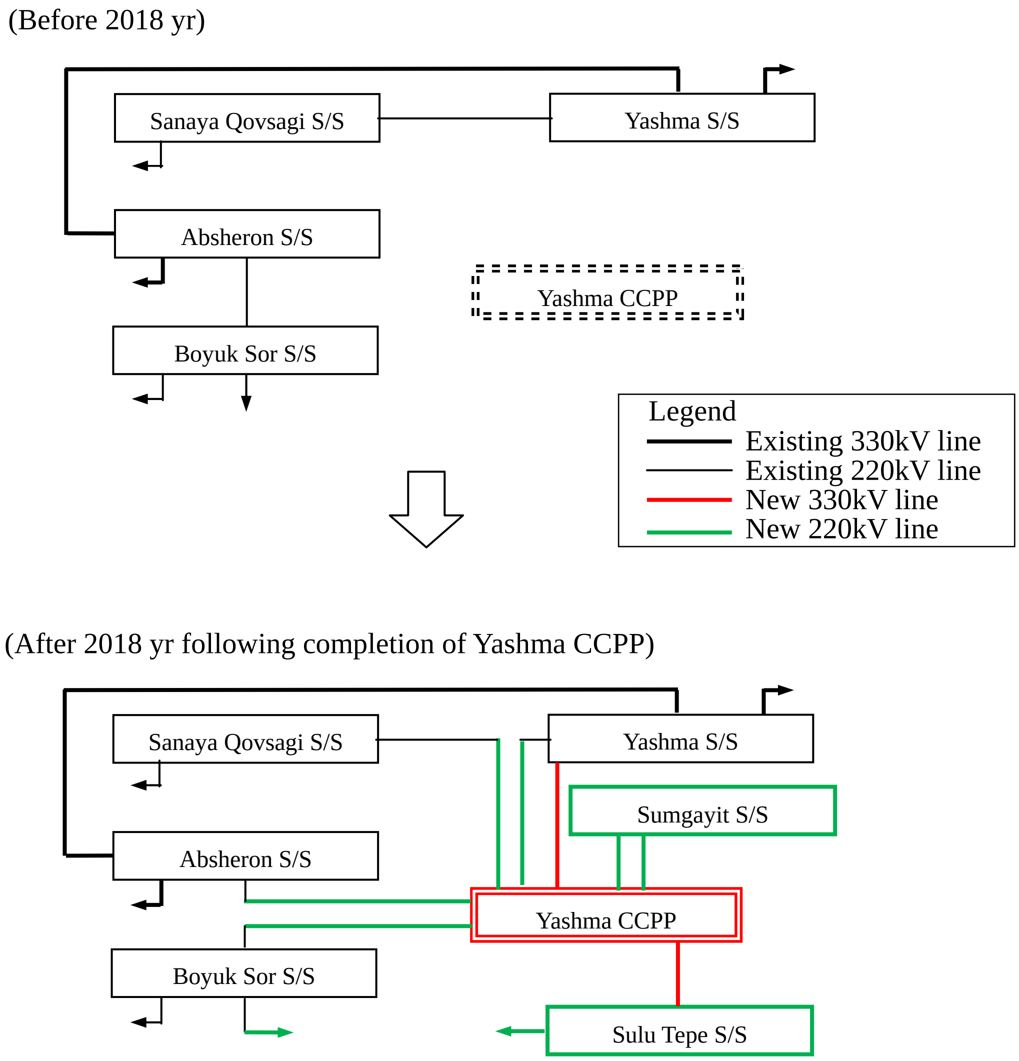


Figure 7.2-1 Grid Connection Plan of Transmission Lines

Figure 7.2-2 Actual Transmission Line Route

7.2.2 Substations

In order to properly transfer the power from Yashma CCPP, reinforcement and new constructions of several substations (hereafter S/S) will be necessary as below.

- Reinforcement of Yashma S/S
- New construction of Sulu Tepe S/S
- New construction of Sumgayit (STP) S/S

This section summarizes the connection plan.

(1) Reinforcement of Yashma S/S

The location of existing Yashma S/S is shown in Figure7.2-3. The 330 kV transmission line (single circuit) will be newly connected from the Yashma CCPP to the Yashma S/S. Hence, a new receiving unit, such as a circuit breaker and a disconnecting switch, should be installed in Yashma S/S.

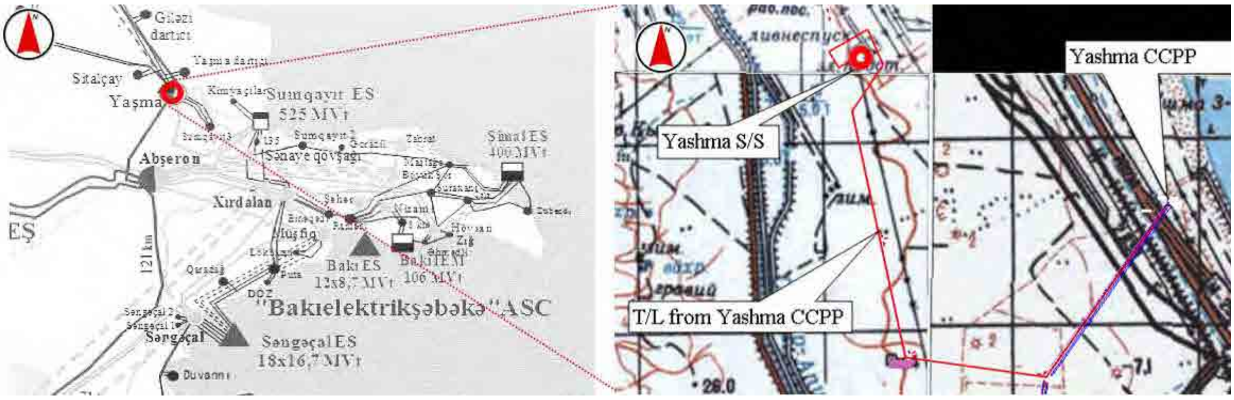
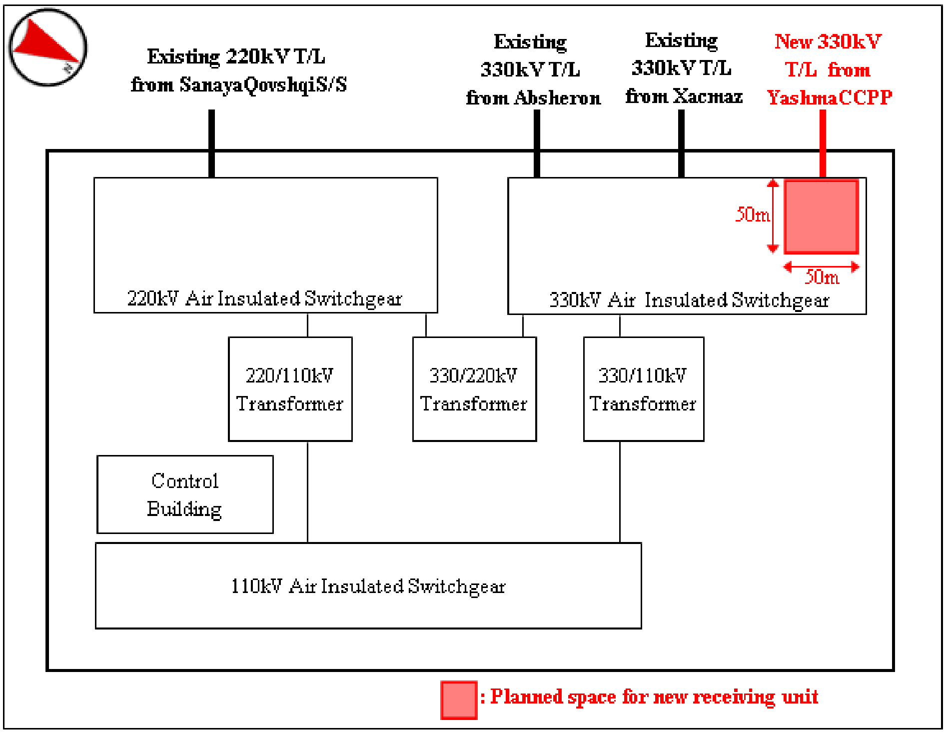


Figure 7.2-3 The Location of Yashma S/S
(Left: The whole, Right: Close up)

The layout of Yashma S/S is shown in Figure 7.2-4. Based on interviews with Azerenerji JSC, a new receiving unit for Yashma CCPP T/L will be constructed on the premises.



Source: Azerenerji

Figure 7.2-4 Layout of Yashma S/S

For reference, pictures of equipment and planned space for the new receiving unit are shown in Figure 7.2-5. The planned space is flat and there should be no obstacles in the construction of new unit.

(a) Planned space for new receiving unit

(b) Existing 330kV Air insulated switchgear

(c) Existing 330kV Transformer

(d) Existing 330kV Circuit Breaker

Figure 7.2-5 Pictures in Yashma S/S

A 50m x 50m area for the new receiving unit is planned on the premises. If the area is insufficient, land procured for Yashma S/S will be expanded into the surrounding area. The surrounding area is public land, and non-residential. Hence, concerns over noise or other issues that could impact the environment are unlikely to occur.

(2) New construction of Sulu Tepe S/S

The new 330kV transmission line (single circuit) will be connected from Yashma CCPP to SuluTepe S/S which is newly constructed. Additionally, other transmission lines will be connected to SuluTepe S/S. Based on Azerenerji JSC’s plan, four 220kV T/Ls and four 330kV T/Ls including YashmaCCPP line will be connected as of 2018. For reference, the planned location of SuleTepe S/S is shown in Figure7.2-6.

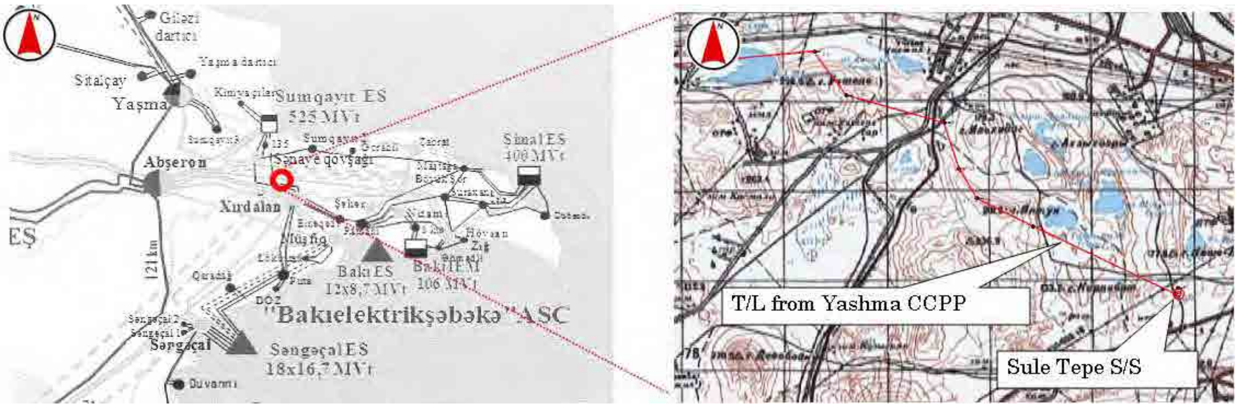


Figure 7.2-6 The Planned Location of Sulu Tepe S/S
(Left: The whole, Right: Close up)

The construction site is shown in Figure 7.2-7. The dimensions for the new construction are 250m x 150m. The site and surrounding area is the public land and non- residential shown in Figure 7.2-7. Hence, concerns over noise or other issues that could impact the environment are unlikely to occur.

Figure 7.2-7 Planned Construction Site for Sulu Tepe S/S

(3) New construction of Sumgayit (STP) S/S
The new 220kV transmission lines (double circuits) will be connected from the Yashma CCPP to the Sumgayit (STP) S/S, which is newly constructed. As set out in this study, Azerenerji JSC has no plan to connect other transmission lines to Sumgayit (STP) S/S. For reference, the planned location of Sumgayit (STP) S/S is shown in Figure7.2-8.

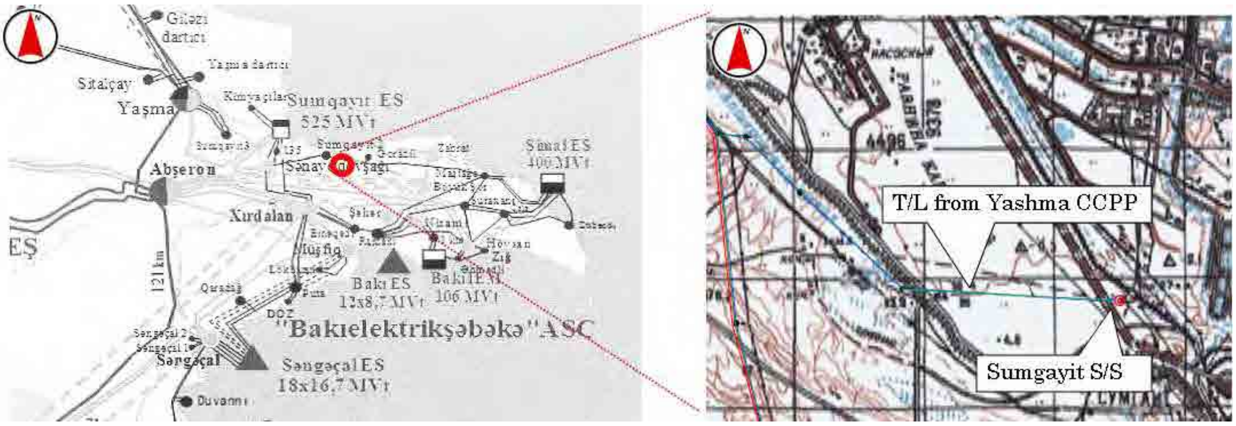


Figure 7.2-8 The Planned Location of Sumgayit (STP) S/S
(Left: The whole, Right: Close up)

The planned construction site for the new Sumgayit (STP) S/S is shown in Figure7.2-9. Although the area is situated between railway lines and a highway as shown in Figure7.2-10, the JICA Study team confirms that no problems are anticipated. As the necessary length for the planned construction of Sumgayit (STP) S/S is approximately 250m, 400m the distance between the highway and the railway lines provides a large enough area. For reference, the dimensions for the new Sumgayit (STP) S/S are 250m x 150m.

The planned construction site and surrounding area is public land, and non-residential, as shown in Figure 7.2-8. Hence, concerns over noise or other issues that could impact the environment are unlikely to occur.

Figure 7.2-9 Planned Construction Site for Sumgayit (STP) S/S

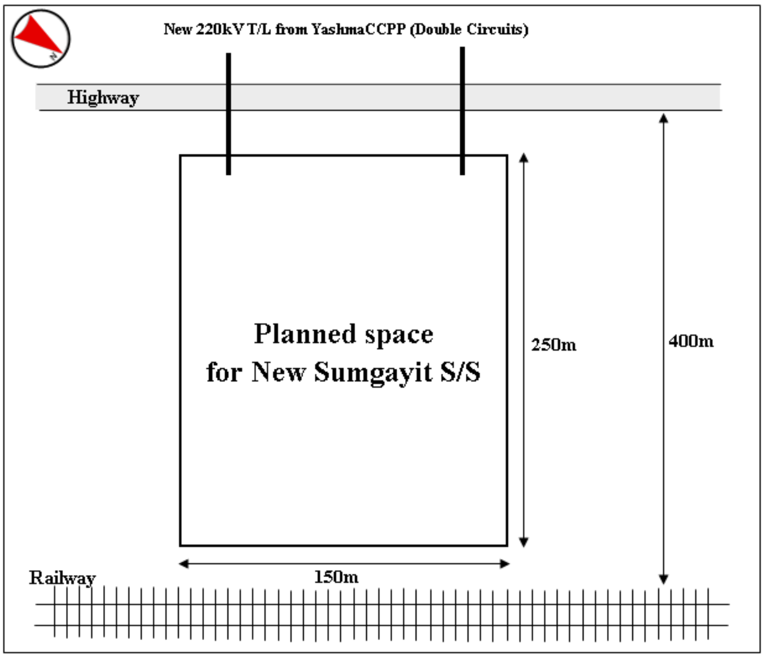


Figure 7.2-10 Planned Construction Site for Sumgayit (STP) S/S

Chapter 8

Basic Design

(This chapter has been removed because of confidential information.)

Chapter 9

Project Implementation Program

(This chapter has been removed because of confidential information.)

Chapter 10

Proposal for Scope of Yen Loan Project

(This chapter has been removed because of confidential information.)

Chapter 11

Proposal for Implementation Strategy and Operation, Maintenance and Management System

Chapter 11 Proposal for Implementation Strategy and Operation, Maintenance and Management System

11.1 Verification of the Project Implementation System, Financial Stability, Technological Capacities and Other of the Implementation Body

11.1.1 Project Implementation System

Azerenerji JSC will establish two organizations in respect of the construction and commissioning of the plant with reference to a similar project. During the construction period, the project leader and deputy project leaders will work at the Baku office. Other employees will work at the Yashma site. The total number of the construction team will be 43 people.

For the commissioning, a total of 30 people, including the site commissioning manager, will be stationed at the Yashma site.

The organization charts for the construction and the commissioning are shown hereunder.

Azerenerji JSC is currently operating many plants itself. Therefore, Azerenerji JSC is capable of operating Yashma CCPP as well as it does other plants.

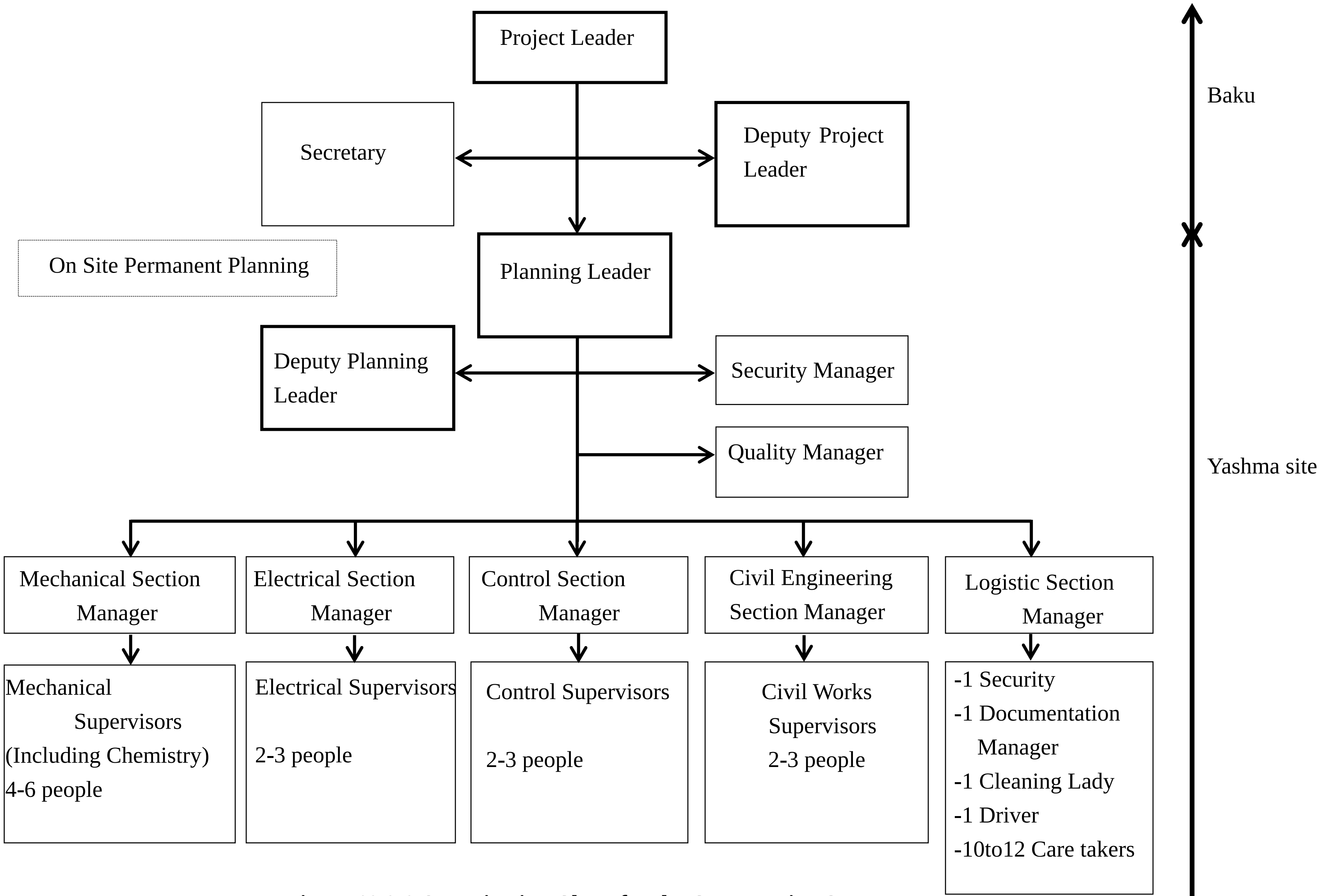
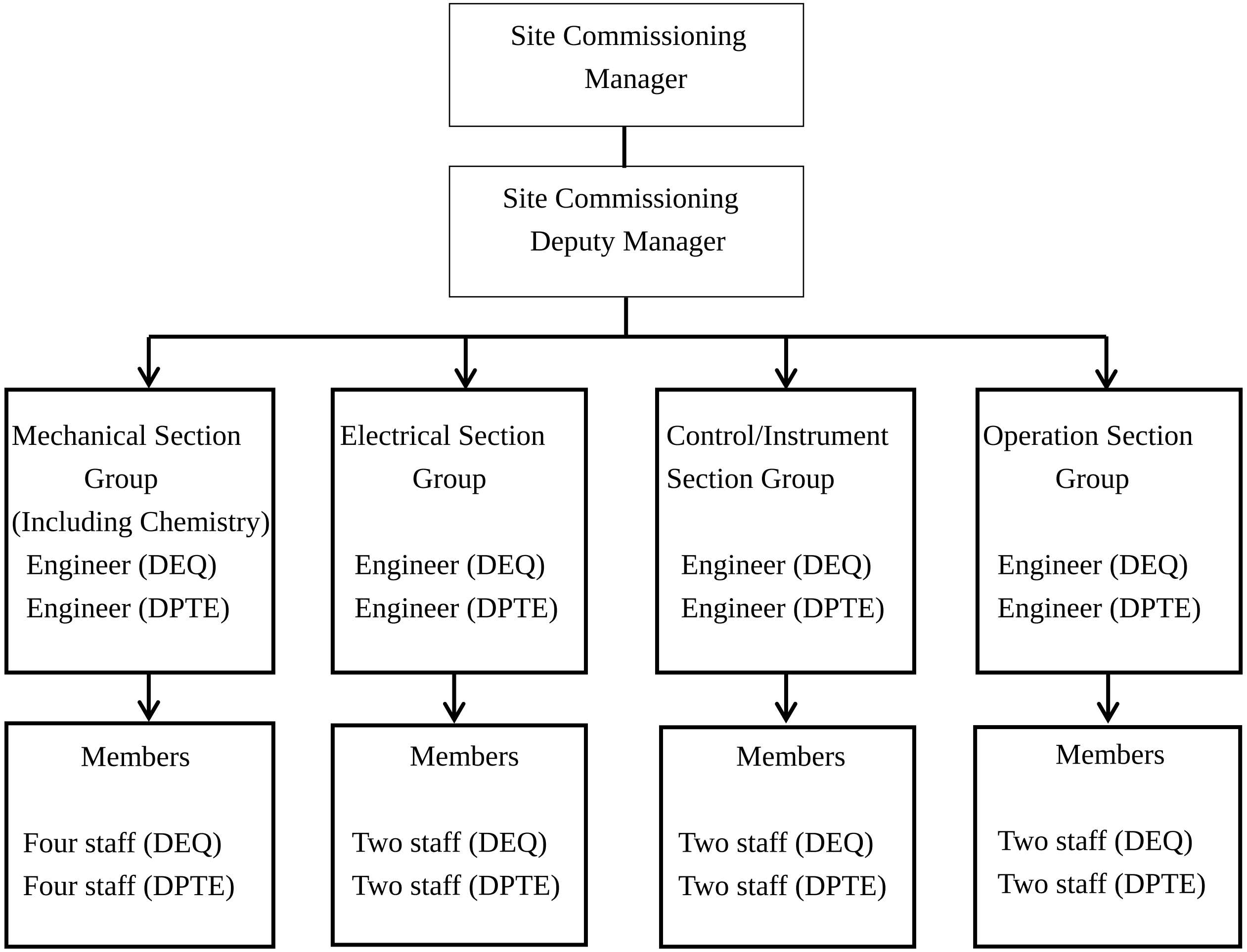


Figure 11.1-1 Organization Chart for the Construction Stage



Notes : DEQ (Direction of Equipment)
DPTE(Direction of Production and Transport of Electricity)

Figure11.1-2 Organization Chart for the Commissioning Stage

11.1.2 Technical Capacities

Azerenerji JSC has experience in the management of engineering, procurement, construction, commissioning and O&M for CCPP in past projects.

Table 11.1-1 shows a record of Azerenerji JSC's past, current and future CCPP projects.

Table 11.1-1 List of Past, Current and Planned CCPP Projects of Azerenerji JSC

Name of Plant	Contractor	GT type	CCPP configuration	Year of initial operation
Shimal	MHI	M701F4	Single shaft	2003
Sumgayit	Siemens	SGT5-2000E	2+1	2010
Janub	GE	PG917F	2+1	2013

Source: JICA Study Team

Since Azerenerji JSC has experience, not only with CCPP projects but also with various GT types and CCPP configurations with different contractors, it has sufficient capability to manage and control a CCPP project through its extensive knowledge of thermal power plant projects. Therefore, Azerenerji JSC has the capability to implement the Yashma CCPP construction project from both technical and management points of view.

11.2 Proposal for the Operation and Maintenance and Management System and Strategy for this Project

This Project can be divided into the following three stages:

- construction stage
- commissioning stage
- commercial operation stage

The JICA Study Team proposes the following strategies for each stage.

(1) Construction Stage Strategy

For the implementation of this project, the JICA Study Team proposes the formation of an organization mainly composed of personnel experienced in the construction work of Shimal, Sumgayit or Janub CCPPs, because the smooth implementation of the Project is ensured if an organization has experienced personnel. The organization should be based on the same scheme as that of Shimal currently being implemented, as illustrated in Figure 11.1-1. The mechanical, electrical, control and civil engineering sections will be in charge of the safety, quality and process management. The mechanical section will mainly be in charge of the construction of the steam turbine, gas turbine, the HRSG and auxiliaries, desalination and demineralization parts. Security and cleaning inside the plant premises will be the responsibility of the logistic section.

The following describes the major work contents in the construction stage.

1) Safety management

The Contractor will be requested to submit a safety plan before starting work. The safety policy, safety measures and communication plan in the event of an accident on the part of the Contractor will be evaluated and approved if satisfactory. The Contractor will be requested to take further measures if required.

Verification will be made on regular and irregular on-site patrols to check if safety management of the work is performed by the Contractor in conformity to the safety plan.

2) Quality management
Approval will be given after design details have been checked to make sure that the Contractor's requirements are met. If the Contractor's design is unsatisfactory, the Contractor will be requested to resolve such problems. During construction work, major verification items will be determined by consultation with the Contractor. Verification will be made in conformity to the progress of the work. A witnessed inspection will be carried out with regard to the major equipment before being shipped from the factory to ensure that the required performances are satisfied.

3) Process management
Before the construction work is started, the Contractor will submit a construction schedule so that adequacy of the work progress can be checked. During the construction period, monthly, weekly and daily process verification meetings with the Contractor will be held on a periodic basis to keep track of the progress. If there is any delay, discussion will be held with the Contactor to find measures for making up time if delays occur.

(2) Strategy in the Commissioning Stage
The organization of the commissioning stage is shown in Figure 11.1-2. An operation group, instead of a civil engineering section, will be organized. Personnel in charge at the mechanical, electrical and control/instrument sections are recommended to take charge of the commissioning stage that follows the construction stage. Furthermore, the JICA Study Team recommends that the operation group should be mainly composed of personnel experienced in the operation of CCPPs. This operation group can take advantage of the commissioning period to acquire operation skills under the instruction of the Contractor.

The following describes major work contents in the commissioning stage.

1) Safety management
The Contractor will be requested to submit a safety plan for commissioning before starting work. The safety policy, safety measures and communication plan in the event of an accident on the part of the Contractor will be evaluated and approved if satisfactory. The contractor will be requested to take further measures if necessary. Verification will be made through on-site patrols to check if safety management during the commissioning period is being performed by the Contractor in conformity to the safety plan.

2) Quality management
Before the commencement of the commissioning stage, the Contractor will be requested to submit commissioning procedures for each facility. The details will be checked and approved if satisfactory. Commissioning of each facility will be conducted, and verification will be made to make sure that operation performances are satisfactory. In the comprehensive plant commissioning phase, verification will be made to see whether the requirements of performances such as plant output and efficiency are being met or not.

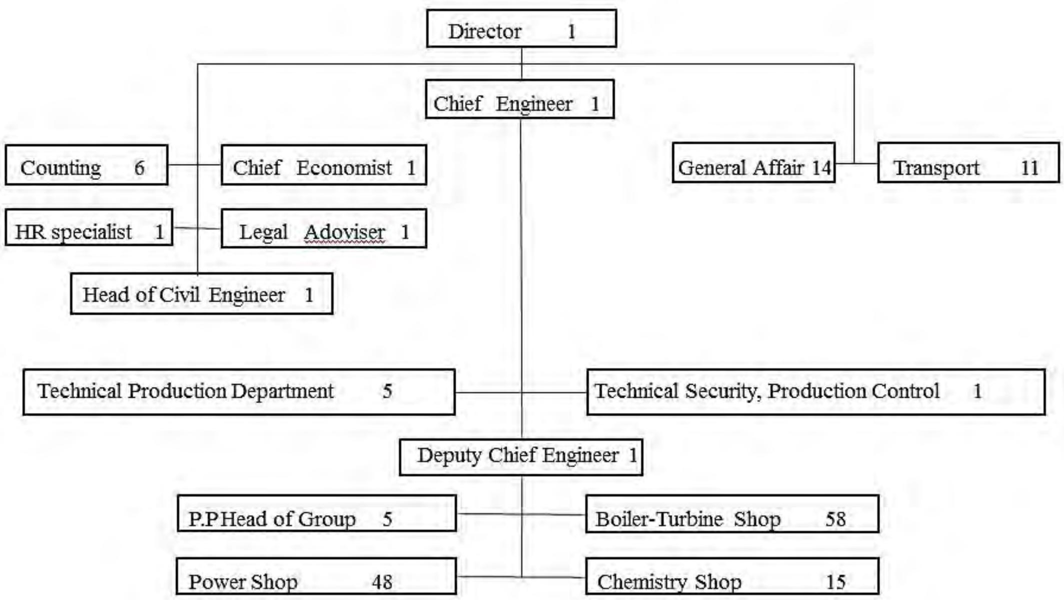
3) Process management
Prior to the commencement of commissioning, the Contractor will be requested to submit

a commissioning progress chart. Verification will be made to see if this chart is adequate or not. During the commissioning period, monthly, weekly and daily process verification meetings with the Contractor will be held on a periodic basis to keep track of progress. If there is any delay, discussions will be held with the Contactor to find ways of making up for any delays so that the Contractor can deal with them.

(3) Strategy in the commercial operation stage

The organization in the commercial operation stage will be composed of some specialty staff, a general affairs division, an operations division and maintenance division. The operations and maintenance group, including the boiler-turbine shop, power shop and chemistry shop, will be mainly composed of personnel experienced in the commissioning stage.

The following describes the organization and major work contents in the commercial operation stage.



Source: Study Team

Figure11.2-1 Organization Chart for the Commercial Operation Stage

Table 11.2-1 Typical Numbers and Duties of Each Section

Section	Type	Number	Duties
Specialty Staff and General Affairs	Daytime Worker	36	• Specialty staff, including economists, human resources, and legal advisers • Head of Civil Engineering • Technical Security
Chief Engineer (Deputy)	Daytime Worker	2	• In charge of technical affairs regarding the plant equipment • Checking the economical efficiency of O&M

Section	Type	Number	Duties
Technical Production Department	Daytime Worker	5	• Document control of the plant
Power Plant Head of Group	Daytime Worker Shift Worker	5	• Management of the shift workers
Boiler-Turbine shop	Daytime Worker Shift Worker	58	• Operation and Maintenance of the gas turbine, steam turbine , HRSG and auxiliaries • Repair or replacement of the gas turbine, steam turbine , HRSG and auxiliaries after any accidents and for regular and combustor inspections
Power Shop	Daytime Worker Shift Worker	48	• Operation and Maintenance of the power Supply equipment, generator transformers, and Control equipment • Repair or replacement of the power supply equipment, generator transformers, and Control equipment after any accidents, and for regular and combustor inspections
Chemistry Shop	Daytime Worker Shift Worker	15	• Operation and Maintenance of the chemical equipment • Repair or replacement of the chemical equipment, after any accidents and for regular and combustor inspections

Source: Study Team

Azerenerji JSC has approximately a 10-year operation experience of CCPPs since the commencement of the operation of Shimal CCPP in 2003. Furthermore, the Shimal CCPP, using an F-class gas turbine, has been operating since 2003. Since 2005, the availability factor of the power plant has exceeded 90%, and it can be said that Azerenerji JSC has sufficient operation capabilities.

The JICA Study Team proposes the skill up programs mentioned below for further technological improvement in the future.

a. Improvement of operation skills

The operator can acquire operation skills at the time of commissioning. The JICA Study Team proposes the introduction of simulator facilities for the purpose of further improvements of operation skills in the future. Simulator facilities contain the functions of performing a series of operations consisting of gas turbine start-up, parallel-in, rated load and parallel-off operations in plant operations. Furthermore, a trouble simulation function is also provided so that there is training for operation trouble.

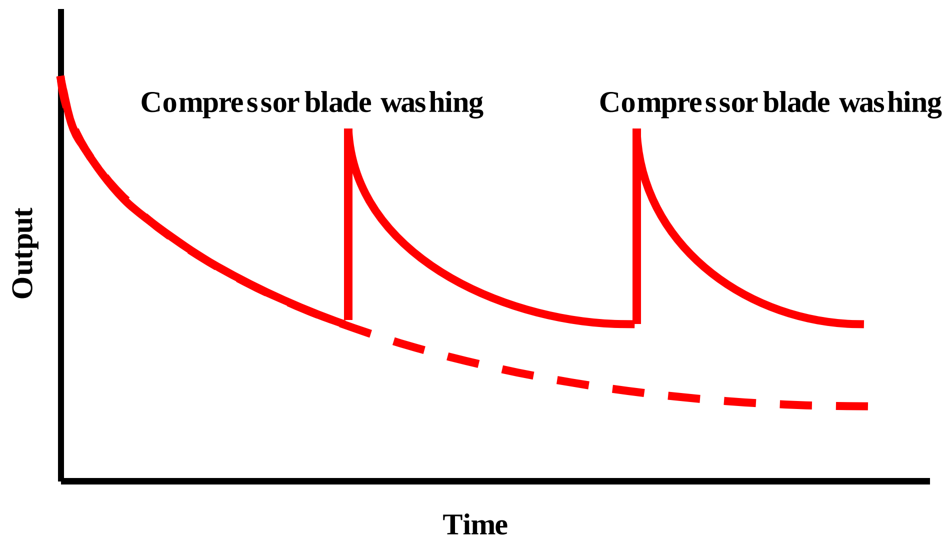
The simulator facilities can be operated on a commonly used PC and are characterized by reduced costs and compact configuration. They can be installed in a training room of the power plant. When software is to be created based on the information of the plant model and control system model in a power plant, the properties inherent to the plant can be represented. This will ensure an advanced level of training efficiency.

b. Improvement of performance management skills

One of the biggest causes for deterioration of gas turbine performance is found in the contamination of the compressor passageway. When the gas turbine has been in operation for a long period of time, foreign substances that cannot be removed from the air sucked into the compressor will deposit on the vane and passageway of the compressor, resulting in contamination. Contamination of the compressor will reduce the air flow rate and compressor efficiency so that the output will be subjected to a gradual reduction and the fuel consumption rate will be increased, resulting in a reduction of gas turbine performances. Compressor blade washing is a method for recovery in the performance of the gas turbine.

The frequency of washing the compressor blades is determined by the trade-off between the profit gained by improving the gas turbine efficiency and the loss caused by suspension of the gas turbine. The JICA Study Team would like to propose that the optimum compressor blade washing frequency be determined by subsequently accumulating operation data and compressor blade washing efficiency data.

Figure 11.2-2 illustrates a conceptual view of the compressor blade washing efficiency.



Source: Study Team

Figure 11.2-2 Conceptual View of the Compressor Blade Washing Efficiency

c. Improvement of maintenance skills of the gas turbine

The CCPP includes major equipment consisting of a gas turbine, steam turbine and HRSG. The maintenance level of the gas turbine, in particular, has a serious impact on the availability factor of the overall power generation facilities.

The combustor and turbine blade as hot parts of the gas turbine are operated at a high temperature of more than 1,000°C. Thus, these hot parts require inspection, repair and replacement over shorter intervals of time due to more serious deterioration and damage, compared with the blade of the steam turbine. For each of these hot parts, the expected service life and inspection time intervals are determined by the Original Equipment Manufacturer (OEM). Table 11.2-2 illustrates examples of time intervals for gas turbine inspections. The hot parts should be inspected and replaced under supervision of a technical advisor of the OEM.

Table 11.2-2 Examples of Time Intervals for Gas Turbine Inspections

Type of Inspection	Inspection Interval
Combustor Inspection	12,000 hours
Turbine Inspection	24,000 hours
Major Inspection	72,000 hours

Source: Study Team

Since the hot parts are made of super alloy based on nickel and cobalt, special welding techniques and coating skills are required to repair these parts. Thus, it is common practice to repair these hot parts at the OEM factory. Generally, approximately three months are required to repair the hot parts, although this depends on the degree of particular damage. Furthermore, when consideration is given to the transportation period from the power plant to the OEM factory, a considerable period of time will be required. To solve this problem, one set of spare parts should be kept in stock.

After a warranty period, Azerenerji JSC maintenance will start. The JICA Study Team would like to propose that Azerenerji JSC creates a maintenance contract of six years. This contract would include the dispatch of a technical advisor from the OEM and the procurement of hot parts. Taking advantage of this maintenance contract period, the maintenance division personnel in charge are recommended to acquire maintenance skills by attending the sites where disassembling, assembling and inspection of the equipment are performed by the technical advisor from the OEM.

Chapter 12

Project Costs and Economic and Financial Analysis

(This chapter has been removed because of confidential information.)

Chapter 13

Environmental Social Consideration

Chapter 13 Environmental Social Consideration

13.1 Summary of Project and Environmental Status

13.1.1 Summary of Project

(1) Summary of JICA-financed portion (Yashma Combined Cycle Power Plant (CCPP))

Project site of Yashma CCPP is located at the north side of the base of Absheron Peninsula, with Caspian Sea on the east.

The closest residential area, Zeynaladbin Tagiyev settlement, is approximately 400 m south of the project boundary (Figure 13.1-1). The site is a desert area and not agricultural nor residential.

The planned project site has been governed by government, and all concerned governmental organizations have no claim on the usage of the site.

Yashma CCPP construction plan relates to the construction of 2 units CCPP (920MW Total capacity) with high heat efficiency using natural gas for fuel. The main facilities are gas combined cycle generation units (460MW×2), intake tower and outlet of cooling water , water treatment system , switch yard ,central control building and access road about 300m.

Source:Study Team

Figure 13.1-1 Plan of Yashma Project Site and the Surrounding Area

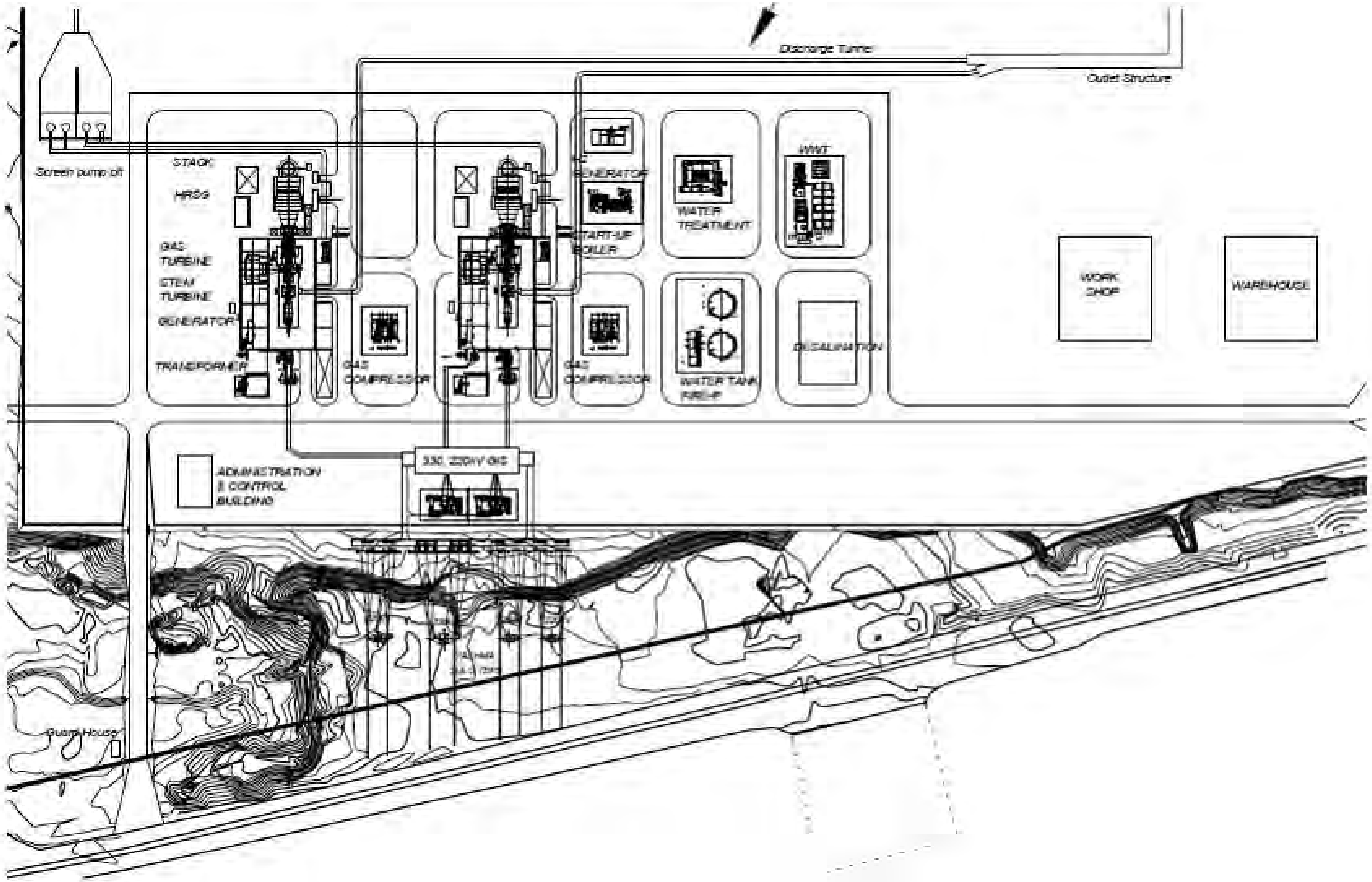


Figure 13.1-2 Conceptual Site Layout for the New Plant

(2) Summary of the Associated Facilities

There are some associated facilities, such as transmission line and substation, gas pipeline and the residential housing for staff.

These facilities are categorized as associated project described in the JICA Environmental Guidelines (2010 April). Therefore, The EIA reports about these facilities are reviewed by JICA survey Team. The summary of EIA report about associated projects is described in Table 13.11.2.

Table 13.1-1 Summary of the Associated Facilities of the Project

Facility	Status
Transmission line and substation	1. The project relates to the construction of new CCPP, and construction of transmission lines and substations are not necessary if the project does not exist. 2. Without the construction of transmission lines and substations, the operation of the CCPP is not possible, nor is the feasibility of the project.
Gas pipeline	1. The project relates to the construction of new CCPP and construction of gas pipeline is not necessary if the project does not exist. 2. Without the construction of gas pipeline, the operation of the CCPP is not possible, nor is the feasibility of the project.
Accommodation for plant staff	1. The project relates to the construction of new CCPP, and the construction of accommodation for power plant staff is not necessary if the project does not exist. 2. Without the construction of accommodation for power plant staff, the well-being of the staff in charge of CCPP operations cannot be, and the feasibility of the project will be seriously disturbed.

Outline of the associated facilities are as below.

a. Transmission line and substation

As shown in Figure 13.1-2, the project proponent is planning a transmission system consisting of one existing substation (Yashma substation) and one new substation (Sulu Tepe substation).

New transmission line of 330 kV or 220 kV will be established.

Existing transmission line and substation are avoiding private farm land, residential areas and landslide area.

Most new transmission lines will pass along existing transmission lines and remaining transmission lines and new substation will be avoiding private farm land, residential areas and landslide area.

Sulu Tepe substation in 40 km south-southeast of the project site, Yashma substation 2 km northeast of the site will be located.

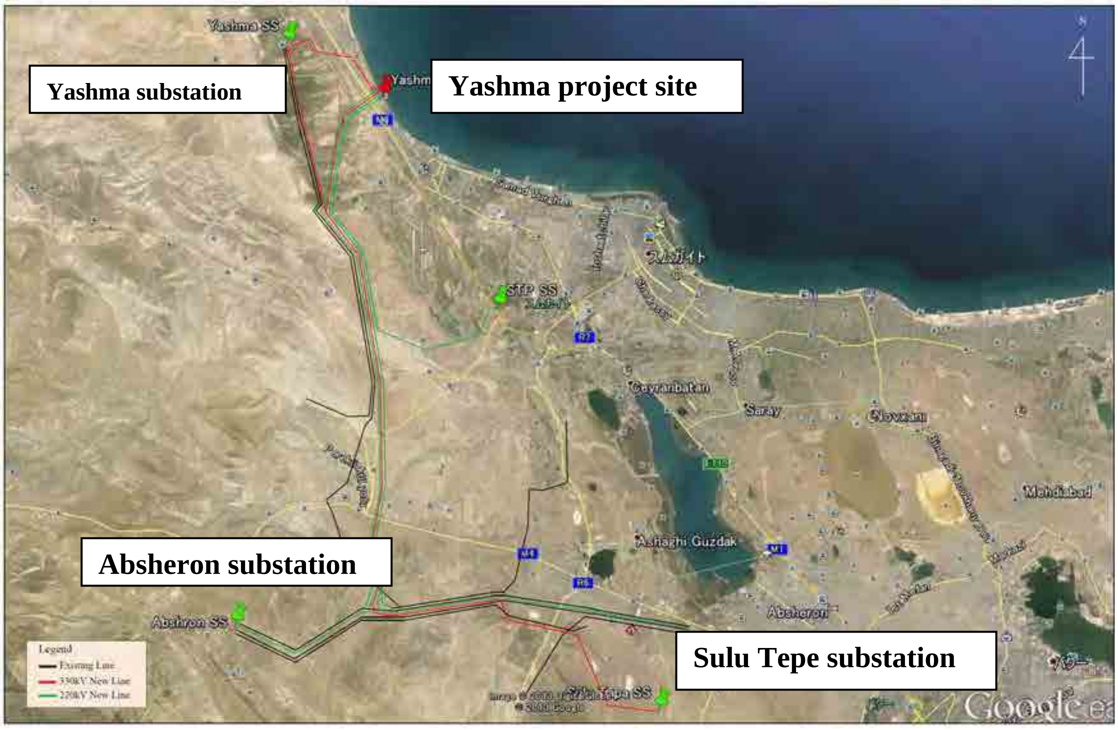
The sites of transmission lines and substations are a desert area and not agricultural nor residential. It is sure that the sites are the governmental land.

The height of the tower is about 20-40 m, the width is about 7-8 m, and the tower is installed every 350 m in general.

Since the length of the transmission line for this project is about 73 km, about 210 transmission towers will be installed for this project (Table13.1-2).

The required area of substations are not so large, about 50 m×50 m or 250 m×150 m (Table13.1-3).

The layout of Yashma S/S and Sulu TePe S/S are shown in Figure 13.1-3 and 13.1-4.



Source:Study Team

Figure 13.1-3 Total Plan of the Transmission Line and Substation

Table 13.1-2 New Transmission Lines for Yashma CCPP

Voltage (kV)	Section of Transmission Line	No. of Circuit	Length (km)	Planned Completion Year
330	Yashma E/S - Yashma S/S	1	8.4	2018
	Yashma E/S - Sulu TePe S/S	1	37.4	2018
220	Yashma E/S – YashmaS/S-Sanaya Qovsagi S/S	2	4.6	2018
	Yashma E/S - Absheron S/S-Boyuk Sor S/S	2	23.5	2018

S/S: Substation

E/S: Power Station

(Source: JSCA)

Table 13.1-3 Substation for Yashma CCPP

Voltage (kV)	Name of Substation	Capacity (MVA)	Area	Planned Completion Year
330	Yashma S/S Extension	1 x 200,2 x 240	50 m x 50 m	2018
330	Sulu TePe S/S	1 x 400, 2 x 250	250 m x 150 m	2018

S/S: Substation

(Source: JSCA)

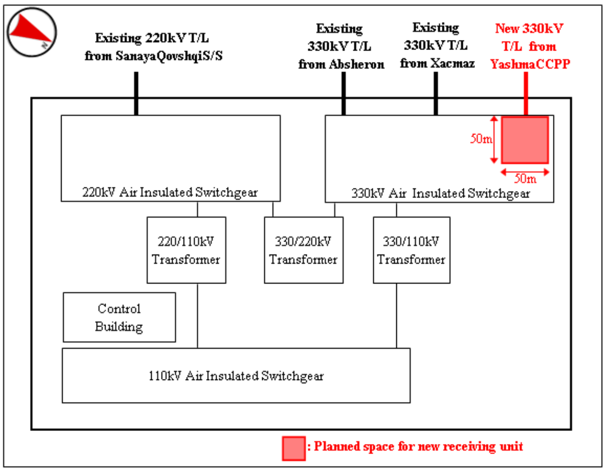


Figure 13.1-4 Layout of Yashma S/S

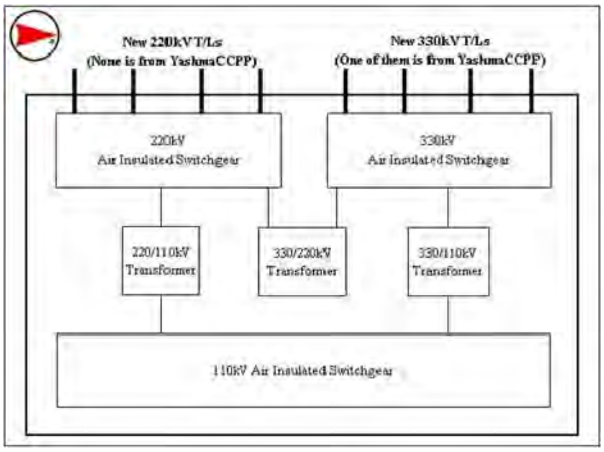


Figure 13.1-5 Layout Plan of Sulu Tepe S/S

b. Gas Pipeline

A branch line was to be installed from the existing gas pipeline along the national road on the west of the site, but the existing pipeline is for civil use and the capacity is not sufficient for use by the power plant.

New gas pipeline route was confirmed in accordance with site investigation. Figure 13.1-5 shows finalized route map of gas pipeline. The gas pipeline will be installed from Aghdere village territory of Khizi region to the power plant. The gas pipeline route length is 48 km and this structure is underground. The route of gas pipeline is almost a semi-desert area and will be avoiding private farmland and residential area. It is sure that the site is the governmental land.

Source:Study Team

Figure 13.1-6 Route of the Gas Pipeline to Power Plant

Main specification for the gas pipeline is shown below. The gas pipeline will be buried about 1~2 m underground. Gas pipeline diameter is 720 mm.

Gas supply volume and pressure are sufficient for Yashma CCPP, and gas compressor is not needed.

The next step is for Azerenerji JSC to carry out the financial arrangements and construction of gas pipeline. After completion of gas pipeline, SOCAR will carry out operation and maintenance of gas pipeline.

c. Residential housing for power plant staff

The residential housing for power plant staff will be constructed in the project site (Figure 13.1-6).

The houses will consist of one building of about 200 people. Details design will planed by JSCA.

Figure 13.1-7 Residential Housing for Plant Staff

The project proponent will include the relevant facilities such as the transmission line, the substations and the gas pipelines described above in the EIA report of the Republic of Azerbaijan to be prepared, in addition to the power plant.

The draft EIA report of the Republic of Azerbaijan is attached as an annex for the confirmation of the environmental social consideration of the transmission line (including substation) and the gas pipeline.

13.1.2 Environmental Status

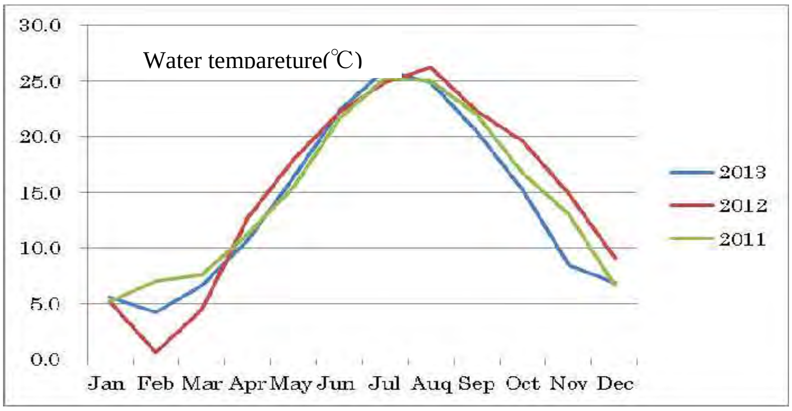
(1) Overview of the Natural Environment

a. Water temperature and salinity

The Figure 13.1-7 shows the Monthly average of sea water temperature and salinity in Sumgayit, which were measured from 2011 to 2013.

Monthly average water temperature in Sumgayit reaches 25 -26 ℃ in summer and below 0-5 ℃in winter as shown in the figure below.

Monthly average salinity Sumgayit reaches 10-12 ‰in summer and below 6-8 ℃ in winter as shown in the figure below.



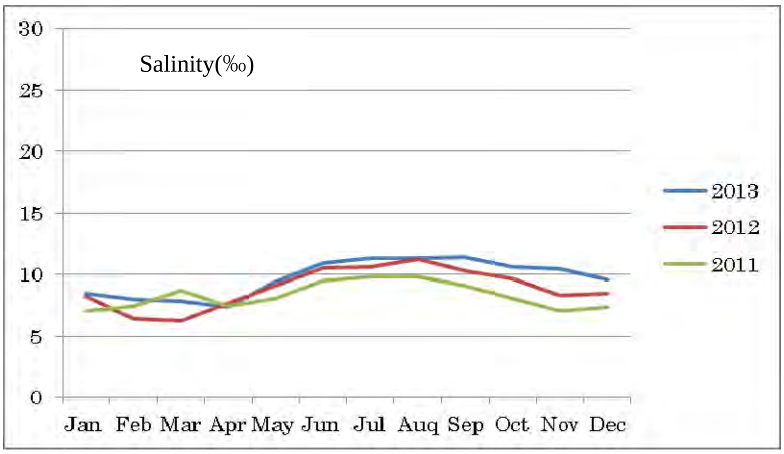


Figure 13.1-8 Monthly Average Water Temperature and Salinity in Sumgayit

According to the vertical water temperature distribution observed between 5 and 20 m water depth near Sumgayit, water temperature of the low layer is lower than that of the surface. It is 2-5 ℃ at the 20 m water depth and 1-2 ℃ at the 5-20 m depth in spring and summer.

b. Hydrology

General current system in Caspian Sea is described. Northern winds prevalent all the year on

the sea create ground streams
According to Table 13.1-4, which shows frequency of streams direction near Sumgayit, streams to the east and south-east (around 40 %) are frequently observed and those to the west and north west(around 30 %)

In addition, the current speed, which is affected by wind velocity, is 10-20 cm/s with moderate wind and can reach 70 cm/s with more than 10 m/s winds.

Table 13.1-4 Frequency of Streams Direction Observed in Sumgayit (%)

Directions of streams	Observation point.1	Observation point.2	Observation point.3
N	10	10	11
NE	7	5	5
E	28	22	22
SE	12	20	20
S	5	4	4
SW	8	4	5
W	17	16	14
NW	13	19	19
Depth	5m	10 m	15m
Distance from shore	2 km	4 km	6 km

c. Climate
The Climate in Azerbaijan differs among the Northern Caspian, the Middle Caspian, and the Southern Caspian. While it is hot, dry and serene in summer regardless of regions, the climate in winter is cold and windy in the Northern Caspian, mild in the Middle Caspian and relatively hot in Southern Caspian.

In the Absheron sea region, where Sumgayit is located, strong winds called “Baku inlet” blow at 30-40 m/s in the direction of North-North-West. Average number of stormy days is 25-30 days during the year and these winds last for 10 hours at a time.

The meteorological observation was made in Sumgayit meteorological station about 20 km southeast of the project site.

The outline of weather-monitoring results at the Sumgayit meteorological station from 2011 to 2013 is described below.

a) Temperature

Average monthly air temperature in Sumgayit reaches 26 -27℃ in summer and below 5℃ in winter as shown in the figure below.

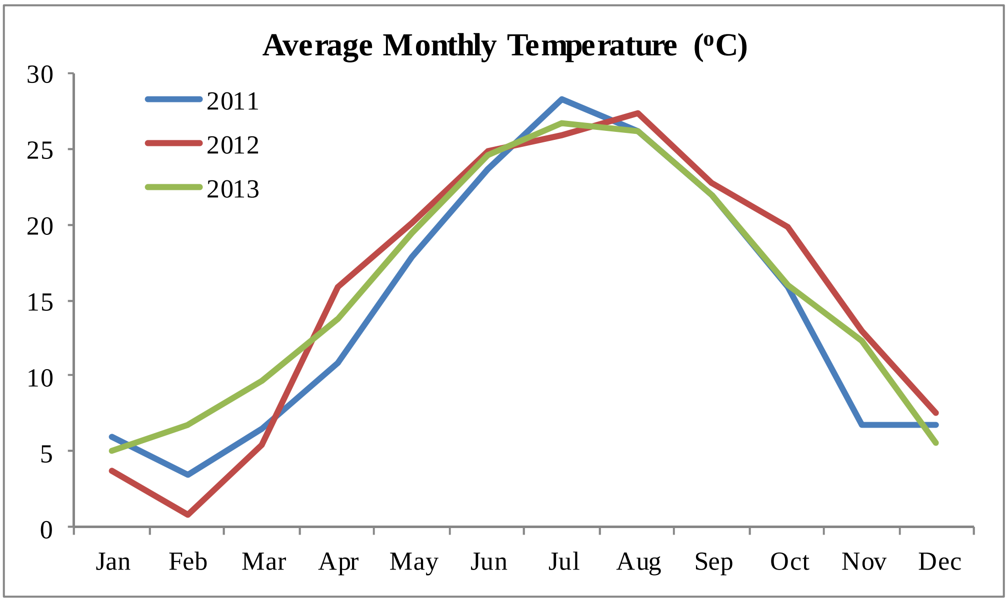


Figure 13.1-9 Average Monthly Temperature in Sumgayit from 2011 to 2013

b) Precipitation

The figure below shows average monthly precipitation in Sumgayit from 2011 to 2013. Summer tends to be dry with little rain, while 70 % of precipitations are concentrated in autumn and winter.

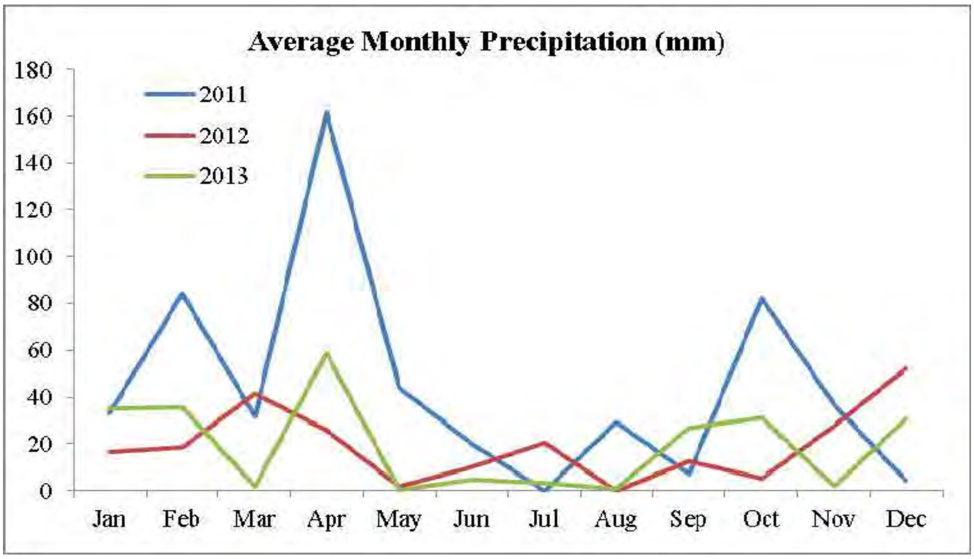


Figure 13.1-10 Average Monthly Precipitation in Sumgayit from 2011 to 2013

c) Wind velocity and wind direction

The figures below show wind direction and wind speed of the year 2011 to 2013 by month in Sumgayit. North, North-West and South winds are frequent though out the year. With regard to wind velocity, strong wind is more frequent in winter, while weak wind is observed more often in summer relatively.

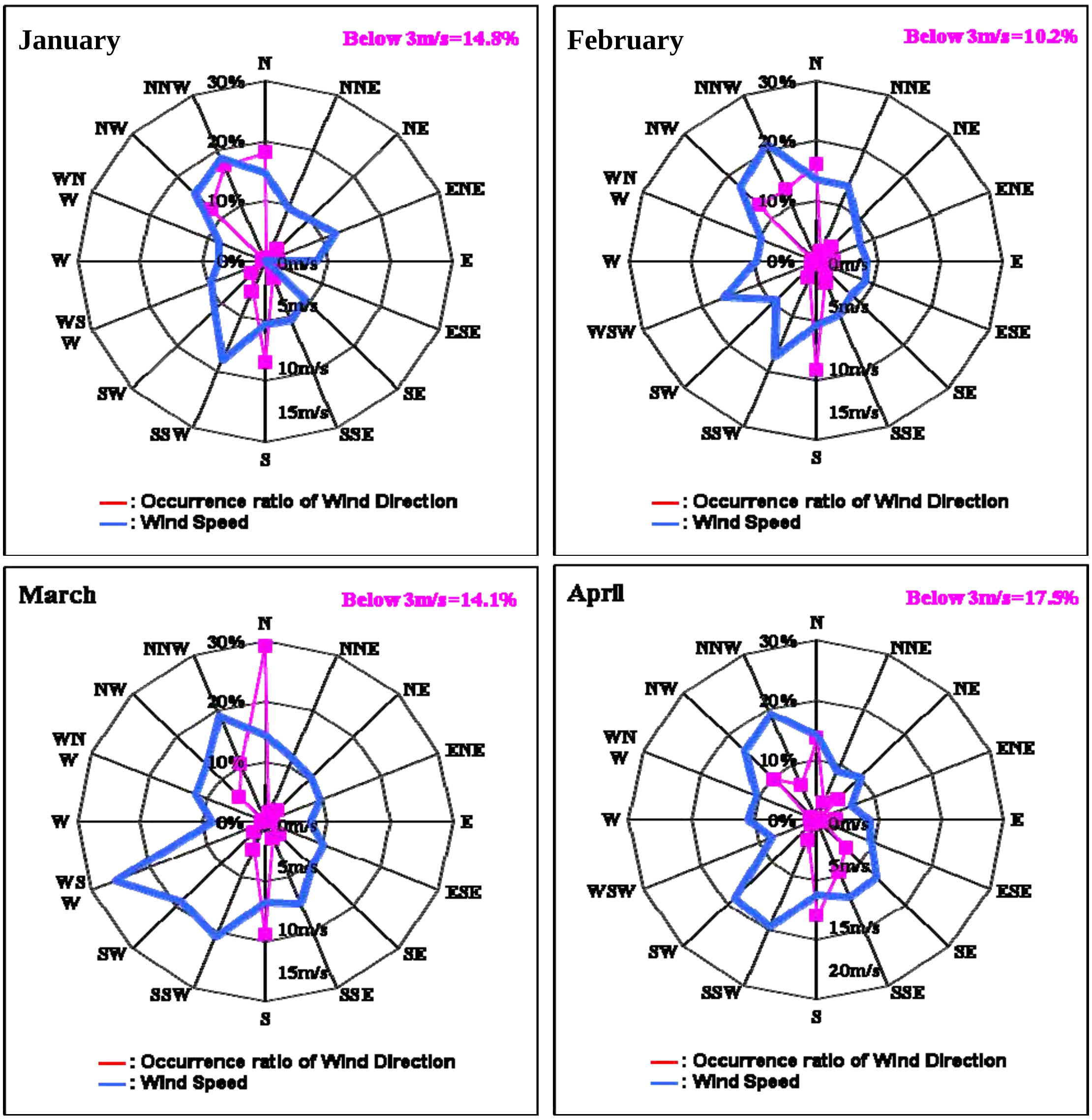


Figure 13.1-11(1) Monthly Wind Velocity and Wind Direction in Sumgayit from 2011 to 2013

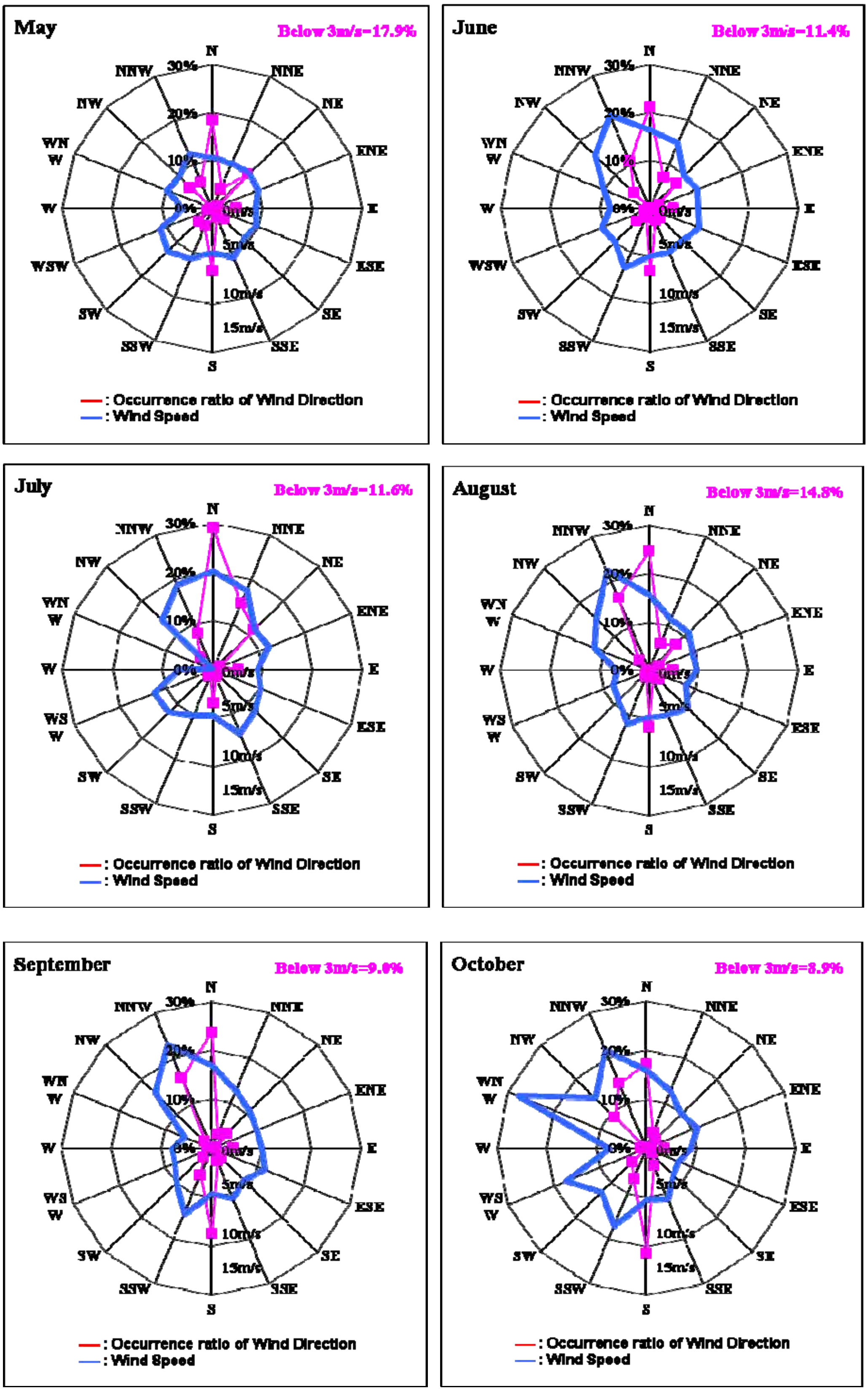


Figure 13.1-11(2) Monthly Wind Velocity and Wind Direction in Sumgayit from 2011 to 2013

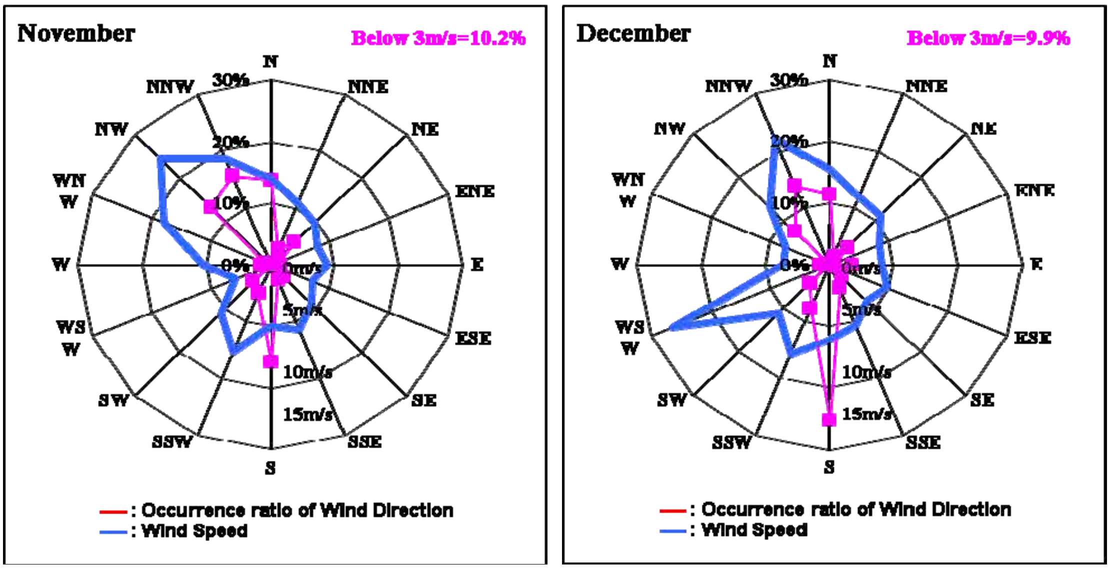


Figure 13.1-11 (3) Monthly Wind Velocity and Wind Direction in Sumgayit from 2011 to 2013

d) Natural parks and protected areas

8 national parks and 35 protected areas (reserve and sanctuary) are designated by the Ministry of Environment and Natural Resource of Azerbaijan. Table 13.1-5 describes the list of the national parks, Table13.1-6 describes the reserves, and Table 13.1-7 indicates sanctuaries. The location thereof is shown in Figure 13.1-11.

No national park or natural reserve is located near the project site. The Altiaghaj national park is proximate to the project site, which is about 40km away from the site in the north-west.

Table 13.1-5 National Parks in Azerbaijan

NO	Name of the SPNA	Administrative territory	Area(ha)	Date of establishment
1	Zangazur NP named after Academician H.Aliyev	Nakhichevan AR	42,797.4	2003
2	Shirvan NP	Garadagh district of Baku city, Salyan and Neftchala regions	54,373.5	2003
3	Aghgol NP	Aghjabadi and Beylagan regions	17,924	2003
4	Hirkan NP	Lankaran and Astara regions	40,358	2004
5	Altiaghaj NP	Khizi and Siyazan regions	11,035	2004
6	Absheron NP	Azizbayov district of Baku city	783	2005
7	Shahdagh NP	Guba, Gusar, Ismayilly, Gabala, Oghuz and Shamakhy regions	130,508.1	2006
8	Goygol NP	Goygol, Dashkasan and Goranboy regions	12,755	2008

Source: MENR website

Table 13.1-6 Natural Reserves in Azerbaijan

NO	Name of the SPNA	Administrative territory	Area(ha)	Date of establishment
1	Gizilaghaj SNR	Lankaran region	88,360	1929
2	Zagatala SNR	Zagatala and Balakan regions	47,349	1929
3	Turyanchay SNR	Aghdash, Oghuz,Yevlakh and Gabala regions	22,488	1958
4	Shirvan SNR	Salyan and Neftchala regions	6,232	1969
5	Basitchay SNR	Zangilan region	107	1974
6	Garayazi SNR	Gazakh region	9,658	1978
7	Ilisu SNR	Gakh region	17,381.6	1987
8	Garagol SNR	Lachin region	240	1987
9	Eldar shami SNR	Samukh region	1,686	2004
10	Mud volcanoes SNR	Baku and Absheron peninsula	20,000	2007
11	Korchay SNR	Goranboy region	4,833.6	2008

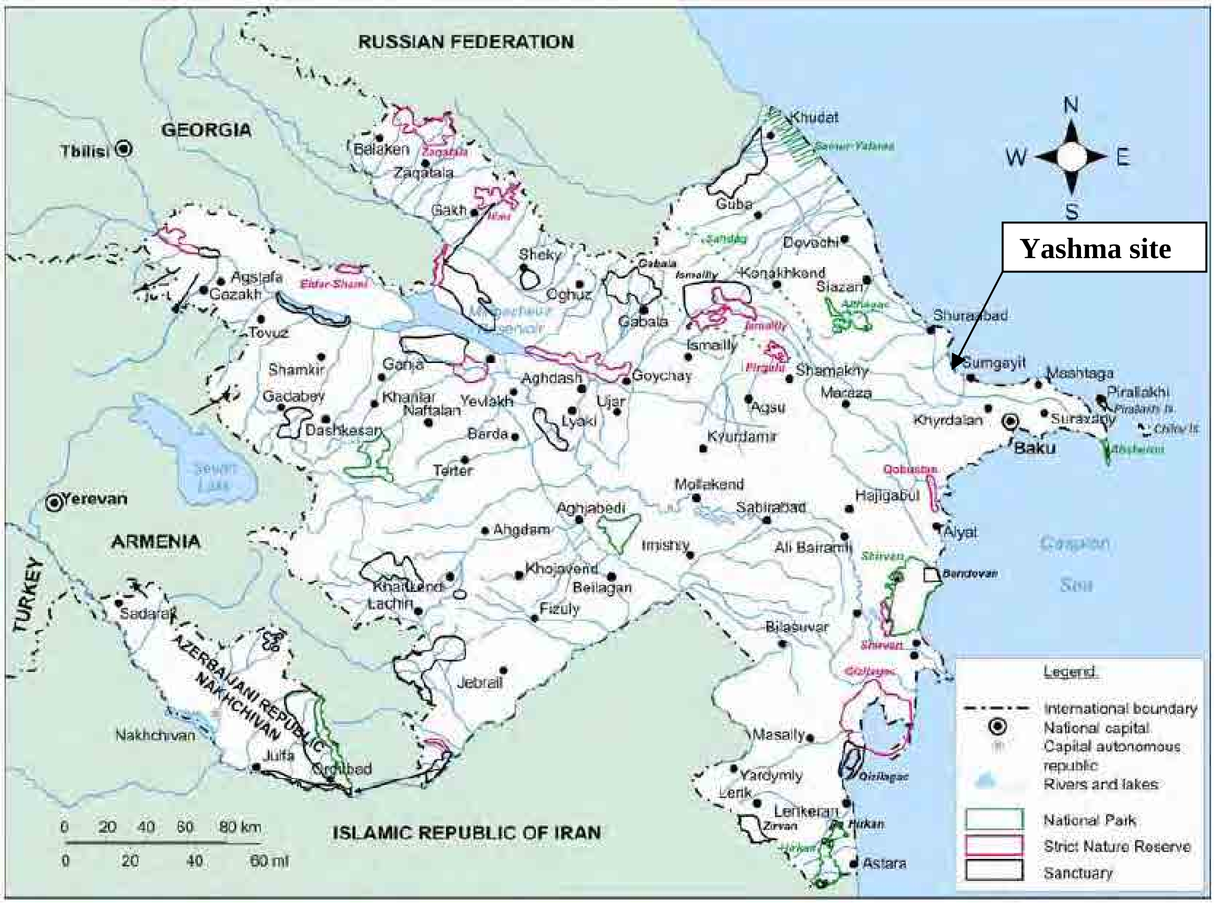
Source: MENR website

Table 13.1-7 Natural Sanctuaries in Azerbaijan

NO	Name of the SPNA	Administrative territory	Area(ha)	Date of establishment
1	Lachin SNS	Lachin region	20,000	1961
2	Korchay SNS	Goygol and Goranboy regions	15,000	1961
3	Bandovan SNS	Salyan region and Garadagh district	4,930	1961
4	Shaki SNS	Shaki region	10,350	1964
5	Gusar SNS	Gusar region	15,000	1964
6	Shamkir SNS	Shamkir region	10,000	1964
7	Gil island SNS	Gil island	400	1964
8	Garayazy-Aghstafa SNS	Aghstafa region	10,000	1964
9	Barda SNS	Barda and Aghdam regions	7,500	1966
10	Zuvand SNS	Lerik,Yardimly regions	15,000	1969
11	Ordubad SNS	Ordubad region	27,869	1969
12	Ismayilli SNS	Ismayilly and Gabala region	23,438	1969

NO	Name of the SPNA	Administrative territory	Area(ha)	Date of establishment
13	Qubadlı SNS	Qubadlı, Lachin region	20,000	1969
14	Lesser Gizilaghaj SNS	Lankaran region	10,700	1978
15	Dashaltı SNS	Shusha region	450	1981
16	Qızılja SNS	Gedebey region	5,135	1984
17	Arazboyu SNS	Zangilan region	2,200	1993
18	Gabala SNS	Gabala region	39,700	1993
19	Gakh SNS	Gakh region	36,836	2003
20	Hirkan SNS	Lankaran and Astara regions	1,553	2005
21	Arazboyu SNS	Nakhichevan AR	9,118	2005
22	Zagatala SNS	Zagatala and Balakan regions	6,557	2008
23	Arpachay SNS	Nakhichevan AR, Sharur region	68,911	2009
24	Rvarud SNS	Lerik region	510	2009

Source: MENR website



Source: Environmental Performance Reviews, United Nations, 2010

Figure 13.1-12 Location of the Natural Parks and Reserves in Azerbaijan

(2) Overview of the Social Environment

a. Land use

The site location is at the north side of the base of Absheron Peninsula, with Caspian Sea on the east, Sumgayıt city on the south

The project site is governmental land and not been privately used for farm land and residential area, etc. The ocean side of the site is sand beach, with only little grass and shrub, no wood were observed.

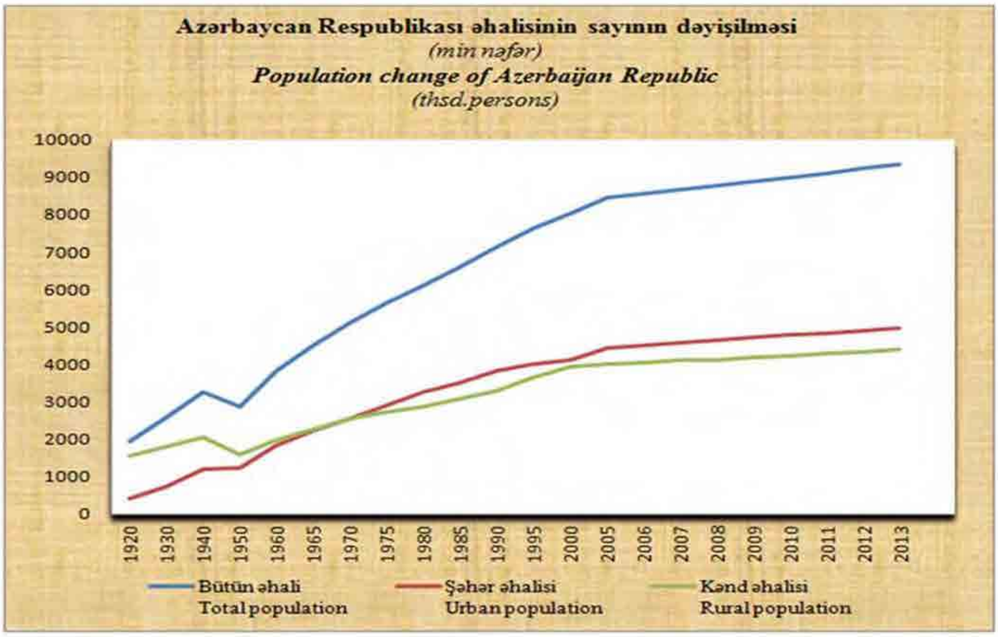
There are a highway and a railway in the west from the site and semi-desert area behind them. Several houses and commercial facilities such as a petrol station exist in the west and south. The nearest settlement, Zeynaladbin Tagiyev Settlement, is located about 400m to the south from the site boundary. Yashma settlement is about 2km away on the north side.

b. Sanitation

Interviews with local people in Yashma settlement reveal problems with drinking water supply, effective waste management, standards of hygiene and sanitation and prevention of infectious diseases. Another issue is that there are no medical services near the settlement. The closest medical facilities are far from the settlement.

c. Population and demography

The total population of Azerbaijan has risen to more than 9.3 million people as at 2013, as shown in the figure below. The population growth rate stayed around 1.3%.



Reference: The State Statistical Committee of the republic Azerbaijan

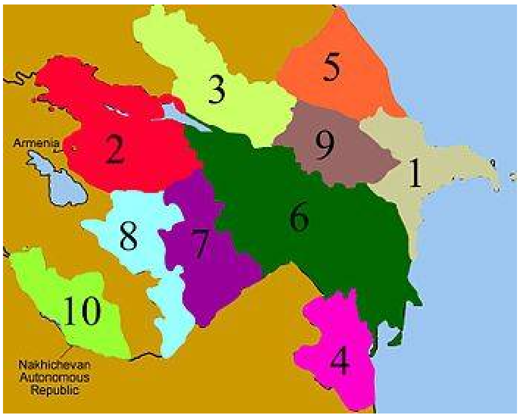
Figure 13.1-13 Change of Population in Azerbaijan (thsd. persons)

The population is significantly concentrated in Baku, the capital, with 2136.3 thousand people. Following Baku, Aran has the second largest population of 1875.5 people, which is the largest economic region in the country.

Table 13.1-8 Population of Economic Regions (thsd. persons)

Reference: The State Statistical Committee of the republic Azerbaijan

Economic and administration regions	Total(thsd. persons)
1)Baku city	2136.6
1)Absheron	533.7
2)Ganja-Gazakh	1210.6
3)Shaki-Zagatal	584.6
4)Lankaran	862.0
5)Guba-Khachmaz	508.5
6)Aran	1875.5
7)Yukharikarabakh	632.8
8)Kalbajar-Lachin	234.7
9)Dakhlik-Shirvan	293.9
10)Nakhichivan	422.9



According to the Table 13.1-9, Sumgayit has a population of 325,200 as of 2012. There is an increase in the population of 5,635, according to the 2012 census. The infant mortality under one year is 131.

Table 13.1-9 Demographic Indicators by Selected Economic and Administrative Regions and Towns of the Country in 2012

Economic and administrative regions and towns	Population size (at the end of year, thsd. persons)	Person			
		births	deaths	increase	infant mortality under 1 year1)
Azerbaijan Republic	**9356.5**	**174469**	**55017**	**119452**	**1884**
Baku city	**2150.8**	**37459**	**12395**	**25064**	**784**
including:					
Binagadi region	251.5	4148	1261	2887	…
Garadagh region	114.4	2795	633	2162	…
Khazar region	158.2	2418	855	1563	…
Sabayel region	94.7	1488	622	866	…

Sabunchu region	231.3	4921	1615	3306	…
Surakhany region	207.0	4061	1247	2814	…
Narimanov region	169.6	2827	944	1883	…
Nasimi region	215.6	2636	1068	1568	…
Nizami region	188.3	3087	969	2118	…
Pirallahi region	18.2	296	137	159	…
Khatai region	261.9	4347	1441	2906	…
Yasamal region	240.1	4435	1603	2832	…
Absheron economic region-total	**538.4**	**10341**	**2635**	**7706**	**148**
including:					
Khizi region	15.5	332	90	242	2
Absheron region	197.7	2593	764	1829	15
Sumgayit t.d.[2]	325.2	7416	1781	5635	131

1) based on data of the Ministry Healthcare

2) İn this and following tables - t.d. is a territory division, t.u. is a territory unit. (t.d. of Sumgayit includes - Sumgait city, 'Haji Zeynalabdin Tagiyev and Jorat settlements; t.d. of Ganja-Ganja city, Goygol and Hajikend settlements; Naftalan city t.u. - Naftalan town and one rural administrative division; t.d. of Shirvan: Shirvan town, Bayramli and Hajigahramanly settlements; t.d. of Khankendi - Khankendi town and Karkijahan settlement; t.d. of Nakhchivan - Nakhchivan city, Aliabad settlement and 3 rural administrative division).

Population of Zeynaladbin Tagiyev Settlement, which is the closest residential area to the proposed project site, has 20,674 with 10,337 male and 10,297 female.

d. Education

There are four highly educational institutions in Sumgayit city: Sumgayit State University, Branch of the Azerbaijan College, Sumgayit State Technical College and Sumgayit Musical College.

In 2013, 3,603 school children finished 9th grade in Sumgayit and 2,887 finished 11th grade.

Siyazan vocational school is located in Zeynaladbin Tagiyev Settlement, Siyazan.

e. Public infrastructure

There are two gas stations, a department of the Ministry of Transport and private café near the proposed project site with about 3 to 5 people working in each structure.

In terms of public utility, all flats of residential buildings in Sumgait are supplied with electric energy and natural gas meter.

Local people complain about a lack of basic infrastructure in Zeynaladbin Tagiyev Settlement, such as school, kinder garden, market, pharmacy and clinic. There are 18 hospitals in Sumgayit, which can accommodate 2,625 sick and wounded people (See Table 13.1-10), but such medical services are far from the settlement.

Educational and communicational facilities are distant, as well. Internal local transport system and access to the settlement from the coast also need improving.

Table 13.1-10 Main Indicators of Health by Economic and Administrative Regions and Towns of the Country

Economic and administrative regions and towns	Physicians, person	Paramedical staff, person	Number of hospitals	Number of hospital beds	Number of ambulance-poly clinic service organizations	Power of the ambulatory-policlinic institutions
Azerbaijan Republic	**32335**	**57506**	**539**	**43198**	**1725**	**105454**
Baku city[1)]	**19044**	**21173**	**130**	**16887**	**293**	**32468**
including:						
Binagadi region	1098	1389	4	634	22	2564
Garadagh region	358	884	9	615	14	863
Khazar region	421	774	10	510	13	1863
Sabayel region	1328	1433	11	1472	24	2411
Sabunchu region	903	1647	9	1040	23	3567
Surakhany region	445	620	7	281	12	2590
Narimanov region	1441	1502	13	882	40	3449
Nasimi region	3044	3971	11	2742	33	2272
Nizami region	837	1044	9	474	21	1682
Khatai region	1080	1314	7	465	27	3784
Yasamal region	1390	1231	**7**	573	33	2840
Absheron economic region-total	**1815**	**3385**	**22**	**2817**	**54**	**3866**
including:						
Khizi region	38	63	1	37	7	261
Absheron region	297	464	3	155	16	1144
Sumgayit city t.d. (Included Z.Tagiyev, Jorat settlements)	**1480**	**2858**	**18**	**2625**	**31**	**2461**

f. Employment

The unemployment rate has decreased from 7.3% to 5.2% between 2005 and 2012 in Azerbaijan, as seen in Figure 13.1-13.

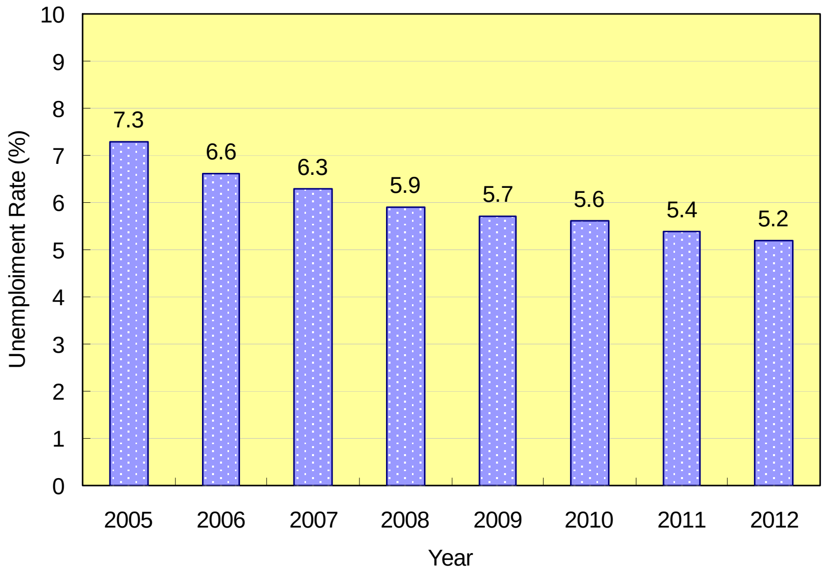


Figure 13.1-14 Unemployment Rate in Azerbaijan

Referring to the figure below, the GDP share by services, industry and agriculture has remained around 56 %, 6 %, and 38 %, respectively during the period between 2005 and 2012 in Azerbaijan. Only the service industry has expanded slightly whereas the labor force engaged in industry and agriculture has been decreased.

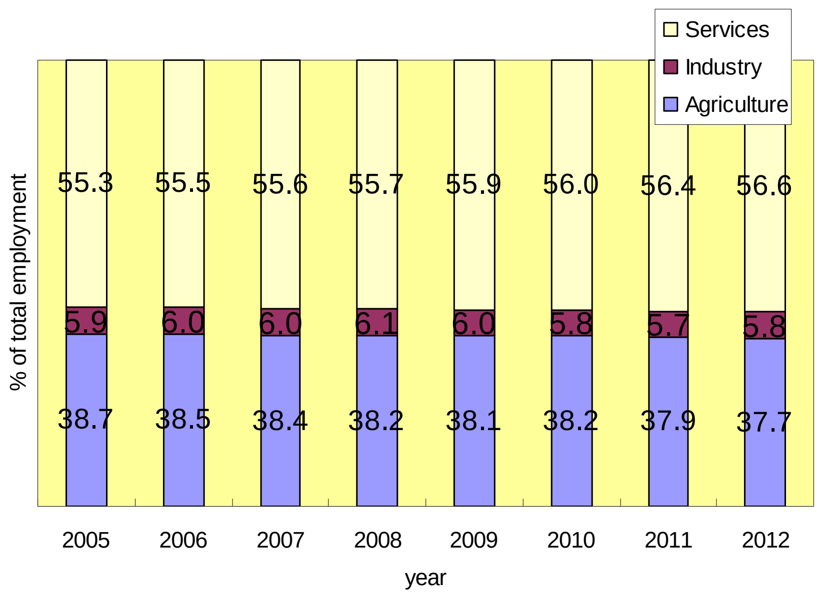


Figure 13.1-15 GDP Share by Sector from 2005 to 2012 in Azerbaijan

In Sumgayit including Zeynaladbin Tagiyev Settlement, there are 50,427 pensioners, 32,840 ages, 13.793 disabled people and 3,794 families losing head. Average amount of fixed monthly pensions is 147.43 Manat. In comparison with the year 2011, number of people receiving grants is raised; whereas, average monthly amount per capita is reduced.

g. Water use

There are few large ships at the sea with more shoals in front of the plant, where water depth gets 7m around 1.3km off the coast.

The fishing in front of the project site is prohibited. In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore.

h. Tourist site

Khizi region, which is located right next to Sumgayit city, have some naturally and historically attractive places.

As for natural sites, Beshbarmak mountainous area and Altiagach national park in Khizi region are well known as one of the most beautiful natural places for their rich flora and fauna. Alti Agach in Khizi region is also famous as one of the most beautiful reserves. It was established for the purpose of preservation of rare animal and plant species of the Greater Caucasus. Those places are located about 40km away from the proposed project site.

i. Cultural and Heritage properties

There are several historically famous places around Alti Agach, which is located about 40km from the site. An ancient caravan route lies from there to Shamakhi located in the direction of southwest of Alti Agach. Even today tourists make tours along this route. Moreover, the Beshbarmak fortress built in the eighth century and the ruins of an antique city and of the Khizi fortress built in the fifth century are historically worth.

j. Minorities

There are many people from different ethnic groups such as akhiska turks, lezghins, tats, kurds, azeris, other refugees and internally displaced people from regions occupied by Armenia. The government of Azerbaijan and international and local NGOs support them to be integrated into local societies.

However, minorities do not live within and near the proposed project site.

13.2 Environmental Impact Assessment and Other Legal System

13.2.1 EIA Related Laws and Regulations

(1) Overview of the environmental administration

The Ministry of Ecology and Natural Resources (MENR) has primary responsibility for environmental regulation. The MENR's statutes were adopted by presidential decree in 2001, making this body responsible for:

• Development of draft environmental legislation for submission to the Azerbaijan Parliament (Milli Mejlis);
• Implementation of environmental policy;
• Enforcement of standards and requirements for environmental protection;
• Suspension or termination of activities not meeting set standards;
• Advising on environmental issues;
• Expert review and approval of environmental documentation, including EIA and
• Implementation of the requirements set out in international conventions ratified by the Azerbaijan Republic (within its competence).

Ministries related to the environmental administration includes, besides MENR, Ministry of Emergency Situations (MES), and Ministry of Health, Ministry of Fuel and Energy.
MENR controls the environmental impact assessment procedure as well as the environmental standard and environmental mitigation measures. Working safety and sanitation is controlled by MES and the Ministry of Health, and fuel supply is controlled by MFE.

(2) Environmental laws

Environmental laws in Azerbaijan include:

✓ 1991 The Land Code of the Azerbaijan Republic
✓ 1995 Azerbaijan Constitution
✓ 1996 Law of Azerbaijan on Pesticide and Agricultural Chemicals
✓ 1997 The Water Code of the Azerbaijan Republic
✓ 1997 Law of the Azerbaijan Republic on Radiation Safety of the Population
✓ 1998 Law of the Azerbaijan Republic on Fishing
✓ 1998 Law of the Azerbaijan Republic on Hydro－Meteorology
✓ 1998 Law of the Azerbaijan Republic On Industrial and Domestic Wastes
✓ 1998 Law Of Azerbaijan Republic On State Land Cadaster, Monitoring Of Lands And Land Structuring
✓ 1998 Law of the Azerbaijan Republic on Subsurface
✓ 1998 The Forest Code of Azerbaijan Republic
✓ 1999 Law of the Azerbaijan Republic on Protection of the Environment

- ✓ 1999 Law of the Azerbaijan Republic on Ecological Safety
- ✓ 1999 Law of the Azerbaijan Republic on Fauna
- ✓ 1999 Law of the Azerbaijan Republic on Water Supply and Wastewater
- ✓ 1999 Law of the Azerbaijan Republic on Fertility of Lands
- ✓ 1999 The Law of the Republic of Azerbaijan on Amelioration and Irrigation
- ✓ 2000 Law of the Azerbaijan Republic on Specially Protected Natural Territories and Objects
- ✓ 2001 Law of the Azerbaijan Republic on Protection of Atmospheric Air
- ✓ 2002 Law of Azerbaijan Republic on Obtaining of Environmental Information
- ✓ 2002 The Law of the Republic of Azerbaijan on Ecological Insurance
- ✓ 2006 Law of the Republic of Azerbaijan on Phytosanitary Control

The fundamental environmental framework in Azerbaijan is regulated in Law of the Azerbaijan Republic on Protection of the Environment and Law of the Azerbaijan Republic on Ecological Safety which are established in 1999.
In addition, there are several decrees and acts to complete those environmental laws.

Azerbaijan accedes to, ratifies and signs the principal international agreements, conventions and protocols concerning environmental protection and conservation of natural resources including:

- ✓ European Convention for the Protection of Animals during International Transport
- ✓ Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971
- ✓ Convention concerning the protection of the world cultural and natural heritage
- ✓ Convention on international trade in endangered species of wild fauna and flora
- ✓ Convention on the conservation of migratory species of wild animals
- ✓ Convention on biological diversity
- ✓ Convention on the Law of the Non-navigational Uses of International Watercourses
- ✓ Convention on the conservation of European wildlife and natural habitats (Bern Convention)
- ✓ Convention on environmental impact assessment in a transboundary context
- ✓ Convention on the protection and use of transboundary watercourses and international lakes
- ✓ Convention on access to information, public participation in decision making and access to justice in environmental matters
- ✓ Kyoto protocol to the united nations framework convention on climate change
- ✓ Framework Convention for the Protection of the Marine Environment of the Caspian Sea
- ✓ Vienna Convention for the Protection of the Ozone Layer (1985)
- ✓ Plant protection convention

- ✓ Basel convention on the control of transboundary movements of hazardous wastes and their disposal (1989)
- ✓ 1979 Convention on long range transboundary air pollution
- ✓ Stockholm convention on persistent organic pollutants
- ✓ Convention on the transboundary effects of industrial accidents
- ✓ International convention for the prevention of pollution from ships, 1973

13.2.2 EIA Regulations and Procedures

In compliance with Article 42 of the Environmental Protection Law, the MENR is a governmental authority, responsible for EIA process.
Recommended guidance on the EIA process in Azerbaijan is provided in the Handbook for the Environmental Impact Assessment Process in Azerbaijan.

A summary of the guidance provided in the handbook is given in the following table13.2-1. The approval of an EIA by the MENR establishes the compliance framework, including the environmental and social standards that an organization should adhere to.

Table 13.2-1 Summary of the Handbook for EIA Process in Azerbaijan

Screening	The developer is required to submit an Application (containing basic information on the proposal) to MENR to determine whether an EIA is required
Scoping	Recommend for a Scoping Meeting to be attended by the developer, experts and concerned members of the public, and aimed at reaching a consensus on the scope of the EIA
Project Description	Full description of technological process and analysis of what is being proposed in terms of planning, pre-feasibility, construction and operation.
Environmental Studies	Recommend to describe fully the baseline environmental at the site and elsewhere, if likely to be affected by the proposal. The environment must be described in terms of its various components – physical, ecological and social.
Consideration of Alternatives	No requirement to discuss project alternatives and their potential impacts (including the so-called “do-nothing” alternative), except for the description of alternative technologies.
Impact Assessment and mitigation	Recommend to identify all impacts (direct and indirect, onsite and offsite, acute and chronic, one-off and cumulative, transient and irreversible). Each impact must be evaluated according to its significance and severity and mitigation measures provided to avoid, reduce or compensate for these impacts.

Public participation	Recommend to inform the affected public about the planned activities twice: first when the application is submitted to the MENR for the preliminary assessment and again during the EIA process. The developer is expected to involve the affected public in discussions on the proposal.
Monitoring	The developer is responsible for continuous compliance with the conditions of the EIA approval through a monitoring program. The MENR undertakes inspections of the implementation of activities in order to verify the accuracy and reliability of the developer's monitoring data. The developer is responsible for notifying the MENR and taking necessary measures in case the monitoring reveals inconsistencies with the conditions of the EIA approval.

Main purpose of EIA process:

- Rehabilitation of natural systems disturbed as a result of previous economic activity;
- Prevention of environmental degradation;
- Environmental-economic balance of future economic development;
- Development of suitable living conditions for people;
- Reduction of environmental hazard level of intended activity.

Whether an EIA is required for the project is determined by MENR based on the document submitted by the project proponent describing the project facility overview. The facility for which MENR decided to require the EIA procedure will, after the EIA approval by MENR, receive approval for construction and operation.

The criteria for determining the necessity of EIA procedure are basically compliant to the World Bank guidelines. In Azerbaijan, however, EIA approval is always required for the construction and operation of a thermal power plant.

Stage I: initiator (applicant) of an activity should apply to the MENR and inform it about the main project solution and potential negative environmental impacts.
After reviewing the application, MENR advises the applicant on importance and scope of the EIA process. In rare cases, an applicant can immediately be licensed for commencement of works.
Stage II: An EIA document prepared by an applicant is reviewed by an expert and a Summary document is released. That document includes proposals and remarks made by the public. A summary document can generally be licensed by the MENR or rejected by stating any grounds for this.

Review period of an EIA document should be a maximum of 3 months for approved by MENR.

Regulations provide requirements for the contents of EIA and the summary document. The applicant receives mandatory requirements with the permit. The main purpose of the above requirements is to ensure concrete definition of environmental impacts and strengthening of control (i.e. management monitoring is considered to be necessary). The requirements also specify environmental monitoring parameters.

Figure 13.2-1 describes the flowchart of the Recommended EIA procedure at the Handbook of EIA in Azerbaijan.

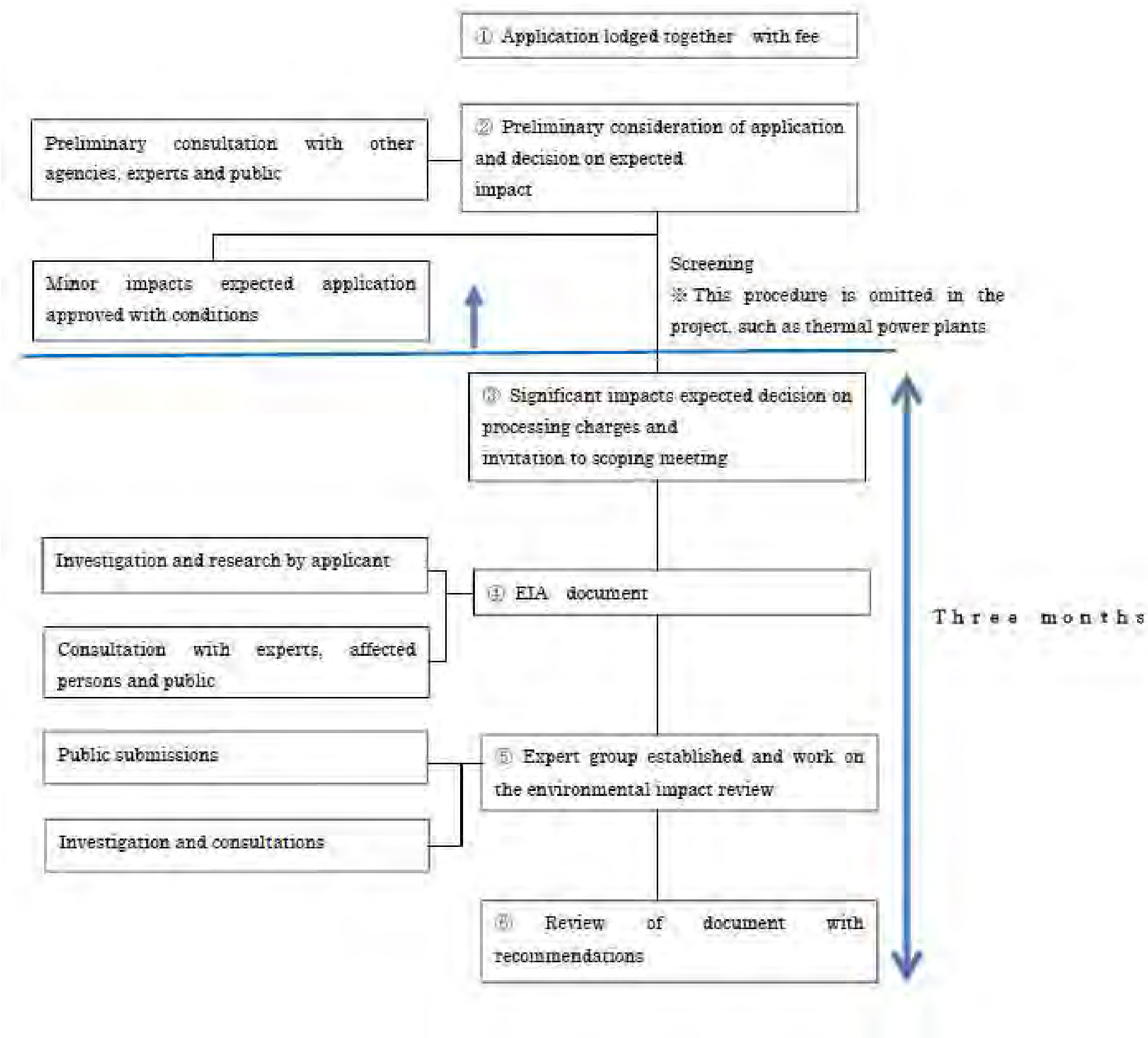


Figure 13.2-1 EIA Recommended Process

The ecological passport described of the expected volume of air and water discharges, the quantity of expected water use, the expected amount of solid waste generated, etc. should be

prepared by an applicant and submitted to MENR prior to the commercial operation.
MENR will review this passport and approve the commercial operation of the project facility
The procedure of ecological passport will be regulatory conducted after operation

13.2.3 Public Participation

In Azerbaijan, the public participation is regulated in Art. 6.1.7 and 7.1.6 of Law of the Azerbaijan Republic on Protection of the Environment. The law stipulates that the public shall be informed of the project summary and the conceivable environmental impact, their response shall be taken into account, and their participation to the project procedure shall be promoted.

The project proponent shall describe the contents and the fact of the project and provide it to the local people by means of media. The project proponent shall also prepare five copies of the EIA to make it accessible by the local people.

The EIA handbook states that the summary and the environmental impact of the project shall be appropriately publicized to the public in the course of EIA implementation process and their opinion shall be given due consideration in the EIA report. It also states that the public consultation meeting is, although not obligatory, a very efficient means in this view.

Azerenerji adopts the policy of holding a public consultation meeting in the course of EIA process during construction of a power plant. They have conducted public meeting in their projects during EIA operation period, construction period, and the project operation period as necessary.

In this project, Azerenerji conducted public consultation in April 2014 in the scoping phase and in July 2014 in the EIA draft final period, in compliance with The Guidelines for Environmental and Social Considerations of JICA (2010).

13.2.4 Environmental Regulations, Legislation and International Guideline

It is important to use limited natural resources effectively and to improve people's lives, when the project is accomplished. And, it is necessary to attempt the equilibrium between the project development and natural environment. In accordance with these properties as above, an Environmental Impact Assessment of this project activity will be done to fulfill regulations and legislation, and is evidence of the implementation and the working of Government policy for the nation’s sustainable development.

When EIA will be conducted EIA for the thermal power plant, International standards such as IFC/WB EHC guidelines which are stricter than the national standard for assessment. For certain items for which national standard is stricter than the international standard, national standard is adopted, and the assessment of this project is conducted in the similar manner.

(1) Air quality

The national ambient air quality standard of Azerbaijan regulates the maximum allowable concentration (MAC) for SO_2, NO_2, NO and PM constituting 24-hour value and the maximum concentration (Table 13.2-2).

The maximum allowable emission (MAE) is established so that the maximum ground concentration (ground surface) calculated by the diffusion model (EKLOG) is below the environmental standard of maximum allowable concentration (MAC).

The emission of air pollutant generated from power plant and other fixed emission source is not regulated by the emission concentration for respective pollutant as is regulated by the international standard.

The EIA statements existing in Azerbaijan do not mention the comparison among the measurement results of existing air quality, the future prospects of concentration and MAC, and also the judgment for conformity with the standards. The survey results are assessed with the comparison with exhaust gas standards and air quality standards in EU standards and IFC/WB Guidelines.

Corresponding international standard for the emission of air pollutant generated from power plant are shown in Table13.2-3.

Table 13.2-2 Environmental Standard for Ambient Air Quality

（Unit：$\mu g/m^3$）

Pollutant	Azerbaijan Maximum allowable concentration （MAC）	IFC/WB EHS guidelines (general)	EU Standards (Japanese Standards)
Sulfur dioxides （SO_2）	500（Once time） 50(24hr) -	500(10 min) 125(24hr) -	350(260)(1hr) 125(200)(24hr) 20(Yearly)
Nitrogen dioxides （NO_2）	85（Once time） 40(24hr) -	200(1hr) - 40(Yearly)	200(1hr) (75-110)(24hr) 40(Yearly)
Nitrogen oxide （NO）	400（Once time） 60(24hr) -	-	-
Dust (Particulate matter)	500（Once time） 150(24hr) -	(PM_{10}) - 150(24hr) 70(Yearly)	(PM_{10}) (200)(1hr) 150(100)(24hr) 70(Yearly)

Reference: Environmental performance reviews, United Nations 2010 and IFC/WB Environmental, Health, and Safety (EHS) Guidelines General, 2007

Table 13.2-3 Emission Gas Standards of Gas Turbine

(Unit ; mg/m^3,(ppm))

Parameter	IFC/WB EHS guidelines (Thermal power plant)	
	Natural gas	Diesel oil
Sulfur oxides (SOx)	-	Use of 1%or less S fuel*1 Use of 0.5% or less S fuel*2
Nitrogen oxides (NOx)	51 (25)	152 (74)
Particulate Matter (PM)	-	50*1 30*2

Notes: The values are converted into 15% of O_2 concentration.
*1: Non-degraded air shed
*2: Degraded air shed; Air shed should be considered as being degraded if nationally legislated air quality standards are exceeded or, in their absence.
(Reference: IFC/WB Environmental, Health, and Safety (EHS) Guidelines Thermal Power Plants, 2008)

(2) Water quality

The maximum allowable concentration (MAC) (surface water) for drink water fishery and Sea water in Azerbaijan is shown in Table 13.2-4, and Domestic waste water standard is shown in Table 13.2-5.

Corresponding international standard for Power plant waste water and domestic wastewater are also shown in Table 13.2-5 and Table13.2-6.

Plant waste water from the power plant is regulated by MAC regarding water quality for drink water, fishery area and sea water.

When conducting water discharge except domestic waste water, MAD (maximum allowable discharge) shall be calculated.

The discharge of pollutant generated from power plant and other industrial sources are not regulated by the concentration for respective pollutant as is regulated by the international standard.

As thermal water from power plant, Azerbaijan standard which allows the increase of more than 5℃ within 500m.

Table 13.2-4 Water Quality Standard of Azerbaijan

Item	Unit	Azerbaijan Water quality standard(MAC)		
		Drink water	Fishery	Sea Water
Hydrogen-ion concentration（pH）	-	6～9	6,5~8,5	6,5~8,5
water temperature	°C	-	⊿6℃	-
Dissolved oxygen（DO）	mg/l	≥4.0-6.0	≥6	≥4.0-6.0
Suspended solid（SS）	mg/l	1.0	-	35
Oil and Grease	mg/l	0.0	0.05	0.05
Phenol	mg/l	-	0.001	0.001
Chemical oxygen demand（COD）	mg/l	15	-	125

Item	Unit	Azerbaijan Water quality standard(MAC)		
		Drink water	Fishery	Sea Water
Biochemical oxygen demand (BOD)	mg/l	3	3.0	25
Total residual chlorine	mg/l	350	0.0	-
Ammonia nitrogen（NH_4）	mg/l	-	2.90	0.5
Nitrite(NO_2)	mg/l	-	-	0.08
Nitrate(NO_3)	mg/l	-	-	45
Arsenic（As）	mg/l	0.05	0.050	0.05
Boron（B）	mg/l	-	10.000	-
Cadmium（Cd）	mg/l	0.01	0.010	0.005
Chrome（Cr）	mg/l	0.001	0.001	-
Copper（Cu）	mg/l	1.0	0.005	0.01
Fluorine（F）	mg/l	0.7～1.2～1.5	-	-
Iron (Fe）	mg/l	0.3 (1)	0.050	0.05
Lead（Pb）	mg/l	0.03	0.010	0.03
Manganese（Mn）	mg/l	0.1 (0.5)	0.050	0.1
Mercury（Hg）	mg/l	-	0.0001	0.0001
Nickel（Ni）	mg/l	-	0.010	0.01
Selenium（Se）	mg/l	0.01	-	-
Zinc（Zn）	mg/l	5.00	0.050	0.01
Cobalt (Co)	mg/l	-	-	0.01
Aluminum（Al）	mg/l	-	-	0.05

Reference: Azerenerji 2012

Rules on protection of surface waters from pollution by waste waters Baku, 1994

Table 13.2-5 Discharge Standard for Domestic Waste Water

Item	Unit	Azerbaijan Standard value	IFC/WB EHS guidelines (general)
pH	－	6.5 - 7.5	6－9
Water temperature	C°	40	-
TSS	mg/L	15	50
BOD	mg/L	-	30
COD	mg/L	500	125
Oil & Grease	mg/L	0.4	10
Total nitrogen	mg/L	-	10
Total phosphorus	mg/L	-	2
Total coliform bacteria	MPN/100ml	-	400

Reference: Order No.219 dated 10.02.1993 of Baku Executive Power regarding discharged water into the sewerage systems and IFC/WB EHS Guidelines General, 2007

Table 13.2-6 Discharge Standards for Power Plant Waste Water

Item	Unit	IFC/WB EHS guideline (Thermal Power Plants)
pH	—	6 –9
SS	mg/L	50
Oil & Grease	mg/L	10
Total residual chlorine	mg/L	0.2
Arsenic（As）	mg/L	0.5
Cadmium（Cd）	mg/L	0.1
Chrome（Cr）	mg/L	0.5
Copper（Cu）	mg/L	0.5
Iron (Fe）	mg/L	1
Lead（Pb）	mg/L	0.5
Mercury（Hg）	mg/L	0.005
Zinc（Zn）	mg/L	1

Reference: IFC/WB EHS guidelines Thermal power plant, 2008

The maximum allowable concentration (MAC) for sea bottom sediments is shown in Table 13.2-7

Table 13.2-7 Maximum Allowed Concentration (MAC) of Elements in Caspian Sea Bottom Sediments

Elements	Unit	MAC
Oil products	mg/g	0.5
Phenols	mg/g	0.01
Zink (Zn)	mg/g	0.1
Copper (Cu)	mg/g	0.1
Nickel (Ni)	mg/g	0.1
Lead (Pb)	mg/g	0.3
Mangan (Mn)	mg/g	1.0
Cobalt (Co)	mg/g	0.1
Iron (Fe)	mg/g	0.5
Cadmium (Cd)	mg/g	0.05

(3) Noise and Vibration

Table 13.2-8 describes the noise standard regulated in Azerbaijan and IFC/WB. The maximum allowable noise level (MANL) is established for region (residential, industrial, commercial, sensitive area such as hospital, etc.) and time (day or night).

Any standards related to vibration are not set in the Azerbaijan regulations and IFC/WC.

Table 13.2-8 Noise Standard in Azerbaijan

Area	Environmental noise standard in Azerbaijan		IFC/WB EHS guidelines（General）	
	Daytime (7:00-23:00)	Nighttime (23:00-7:00)	Daytime (7:00-23:00)	Nighttime (23:00-7:00)
	Leq (dB)	Leq (dB)	Leq (dB)	Leq (dB)
Industrial area	65	55	70	70
Commercial area	-	-	70	70
Residential area	60	45	55	45
Public facility and tourist facility	50	35	—	—
Hospital and resort facility	40	30	—	—
Agricultural area	50	45	—	—
Quiet area	35	30	—	—

Reference: Recommendations on Environment Protection in Road and Bridge Design, Moscow, 1995 and IFC/WB EHS Guidelines General, 2007

(4) Waste

Waste in Azerbaijan is regulated by the Law of Azerbaijan Republic on Industrial and Domestic Waste No. 514-IQ.

The Law aims at the protection of environment against the impact of hazardous gas and wastewater, industrial waste and domestic waste containing radioactive substance. The law stipulates the responsibility and right of the national government and other organizations, the requirement for design and construction of the waste disposal facility, approval of waste generating activity, storage and transport of waste. The law recommends the introduction of the advanced technology to reduce the generation of waste by the industry. It also regulates the authorization, management and classification of hazardous waste according to the decision of the Cabinet Office under the authorization of MENR.

13.3 Comparison of Alternatives Including Zero-option

13.3.1 Zero Option (in case of not implementing the project)

If this project is not implemented, expected power supply shortage will not be solved (Table 13.3-1).

There is no other options that old electric-generating facilities will be kept operating, which cannot contribute to CO_2 reduction.

Table 13.3-1 Comparison of Project Implementation and Zero Option

Item	If the project is implemented	Zero option
Technical aspect	・A power plant will be constructed in the project site.	・Nothing in particular
Economic aspect	・Although it requires construction costs, the project will contribute to economic development in the Azerbaijan Republic. In addition, the project will purchase construction materials and equipment in the local area and also offer working opportunities to local people, contributing to the local economy. ・The obsolete thermal power plant will be closed down and energy efficiency and fuel cost savings will be promoted.	· No construction cost will need. However, the economic growth in Azerbaijan will slow down or be negative due to the power supply shortage. In addition, no power construction project will offer neither working opportunities to local people nor contribute to the local economy. ・Because the obsolete thermal power plant cannot be closed down, promotion of energy efficiency or fuel cost savings will be delayed.
Environmental social consideration	・ The new power plant will be constructed, which needs appropriate measures to relieve environmental impact.	・Nothing in particular.

Source: Prepared by the survey team

13.3.2 Comparison of Fuel Types

Natural gas is inexpensive compared with oil. Because Azerbaijan is rich in natural gas reserves, natural gas is the most-consumed fuel for thermal power plants in the country. Since the currently available gas pipeline networks extend in all directions of the country, the cost to construct a fuel storage facility and a port for natural gas-fired power plant will be lower than the cost to construct such facilities for an oil-fired or coal-fired power plant.

Compared with an oil-fired or coal-fired power plant, the natural gas-fired power plant emits into the atmosphere less SOx, dust and CO_2. In addition, since the required site area is smaller than that of the other types of power plant, the land acquisition and reclamation will have less impact (Table 13.3-2).

Table 13.3-2 Comparison of Fuel Types

Item	Natural gas	Oil	Coal
Technical aspect	• If gas is supplied through the pipeline, no port and harbor facilities for LNG tankers are needed to construct. • The above case will require neither large-scale LNG tanks nor an ash dump site to build. • Natural gas is applicable to high-efficiency combined cycle power generation which employs F-class gas turbine technology and achieves thermal efficiency more than 55%. (ref. Chapter 8)	• The construction of port and harbor facilities will be needed for ships that will carry in and disembark oil fuel. • Large-scale oil tanks will be needed to build. • Heavy oil cannot be used as fuel for high-efficiency combined cycle power generation.	• The construction of port and harbor facilities will be needed for ships that carry in and disembark coal. • A large-scale coal yard and an ash dump site will be needed to build. • Commercial operation is not yet available for coal gas-fired high-efficiency combined cycle power generation.
Economic aspect	The fuel unit price of natural gas is higher than coal but lower than oil. • Compared with the cost to construct port, harbor, and fuel storage facilities, the cost to build a short-distant pipeline is very inexpensive. • Azerbaijan has a lot of reserves and production volume of natural gas and the corresponding pipelines have been developed.	• The fuel unit price of oil is the most expensive of the three types of fuel. • The cost to construct port, harbor and storage facilities will be expensive. • A site will be needed for large-scale oil tanks. Azerbaijan has a lot of reserves and production volume of oil and the corresponding pipelines have been developed.	• The unit price will be inexpensive. • The cost to construct port, harbor and fuel storage facilities will be expensive. • To acquire sites for a coal yard and an ash disposal site is needed. Azerbaijan has no coal reserves.
Environmental social consideration	• Since this fuel type has neither ash content nor sulfur content, no dust and SOx will be generated. • The CO_2 generation volume is least among the three types of fuel. • Since the total site area is relatively small, impact from the land reclamation and compensation will be minor.	• Since this fuel type has ash content and sulfur content, dust and SOx will be generated. In addition, depending on the sulfur content, a desulfurizer will be needed. • The CO_2 generation volume from oil is greater compared with that from natural gas. • Since the total site area is relatively large, impact from land reclamation and compensation will be great.	• Since this fuel type has ash content, a dust collector will be needed. In addition, depending on the sulfur content, a desulfurizer will be needed. • The CO_2 generation volume from coal will be greater than that from gas or oil. • Since the total site area is relatively large, impact from land reclamation and compensation will be great.

Source: Prepared by the survey team

13.3.3 Comparison of Alternative Site

Selecting the site for this power generation construction project needs to satisfy two major conditions. The site must be close to an area that is expected to have considerable power consumption. The site must also be located near a shore on the Caspian Sea that allows to intake water. Azerenerji have selected and examined a Qobustan site, which is located in the southwestern direction to Baku, the capital of the country, as the other designated spot that satisfies these conditions.

When Azerenerji examined the designated project spot (Yashma spot) and the Qobustan spot, neither spots will ask local people to relocate themselves. Since these spots are neither farmland nor forest, the sites have no much difference in environmental social impacts from land acquisition and reclamation.

In addition, the project implementer has already started official procedure to acquire the site from government for the power plant project in the Yashma spot and decided designated substation spots and a power transmission route. Meanwhile, since the procedure for acquiring the Qobustan site takes time, Azerenerji foresee no smooth construction of a power plant and power supply. That is why Azerenerji have selected the Yashma spot (Table 13.3-3).

Table 13.3-3 Comparison of Alternative Sites

Item	Yashma site	Qobustan site
Technical and economic aspects	• The locations of the substations and transmission line route to supply power have already been planned. • Water for cooling is available. • The project implementer has acquired the site and is just waiting for the completion of the final land registration.	• No locations of the substations and transmission line route to supply power have been decided yet. • Water for cooling is available. • This site is not acquired. It will take time to coordinate administrative agencies concerned and complete the required procedures.
Environmental social consideration	• Since this site is in no residential area, relocation of local people will not be needed. • This site is not located in farmland but in wasteland close to the shore. • This site is located in no forests and wetlands. • A land reclamation will be necessary to construct a new fuel gas pipelines.	• Since this site is in no residential area, relocation of local people will not be needed. • This site is not located in farmland but in wasteland close to the shore. • This site is located in no forests and wetlands. • A land reclamation will be necessary to construct a new fuel gas pipelines.

Source: Prepared by the survey team

Source: Prepared by the survey team

Figure 13.3-1 Locations of the Yashma and Qobustan Site

13.3.4 Comparison of Power Generation Systems

If natural gas is used as fuel for a power plant, the combined cycle power generation system is the highest in efficiency and economy. This is the reason we have selected the combined cycle power generation system (Table 13.3-4).

Table 13.3-4 Comparison of Power Generation Systems

Item	Combined cycle power generation	Conventional thermal power generation
Technical aspect	・There are a number of power plants utilizing this type of system in the world. ・Thermal efficiency of this system can be more than 55% with the use of F-class gas turbine, which is proposed in Chapter 8 Basic Design.	・There are a number of power plants utilizing this type of system in the world. ・Thermal efficiency of this type will be less than 45% even with the most advanced generation of the technology. ・Construction period of conventional thermal power generation is longer than that of combined cycle thermal power generation by the number and kind of equipment.
Economic aspect	Since this power generation is efficient, cost per unit of electricity generated will be law.	Since this power generation is not so efficient as the combined cycle power generation, cost per unit of electricity generated will be high.

Environmental social consideration	・Since this power generation efficiency is high, CO_2 generation per unit of electricity generated will be small. ・Cooling water volume will be small when compared with that of the conventional thermal power plant with the same output. (The ratio of power output from gas turbine to that of steam turbine is approximately 2. This is why the volume of water effluent from the steam turbine condenser will be small.)	・Since this power generation is not so efficient as combined cycle power generation, CO_2 generation per unit of electricity generated will be large. ・Cooling water volume will be large

Source: Prepared by the survey team

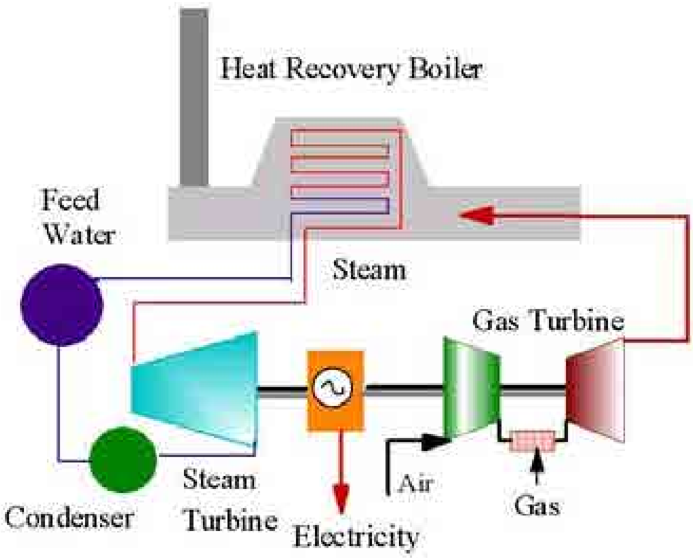


Figure 13.3-2 Mechanism of Combined Cycle Power Generation

13.3.5 Cooling System

There are three (3) types of cooling systems (a once-through cooling system, an induced draft cooling tower cooling system, and an air cooled system) as possible cooling systems for the steam turbine condenser. The merits and demerits of the cooling system are variable depending upon the site conditions.

The once-through cooling system type is commonly employed when the site is located on a seaside, riverside or lakeside, and the circulating cooling water flow rate sufficient to cool the condenser is available economically without environmental impacts. The condenser pressure is normally the lowest among the above three (3) types. Therefore, the steam turbine power output is highest. This system is the most preferable from a plant performance point of view.

The induced draft cooling tower type is commonly used when sufficient circulating cooling water flow rate is not available economically but the water flow rate to compensate for the evaporation and blow-down losses is obtainable. Air cooled type is commonly used when the site is located in places such as deserts and inland areas where cooling water is scarce. The condenser pressure is normally the highest among the above three (3) types. Therefore, the steam turbine power output is lowest. The auxiliary power required to operate the cooling system is highest because many air draft fans must be operated. The installation footprint area for this system is the largest.

The schematic diagrams and the characteristics of the three (3) types of cooling systems are shown on the Figure 13.3-3 and Table 13.3-5 respectively.

The project site for Yashma Power Plant is located at a shore on the Caspian Sea and sufficient amount of sea water is available, hence the once-through type is adopted for the cooling system.

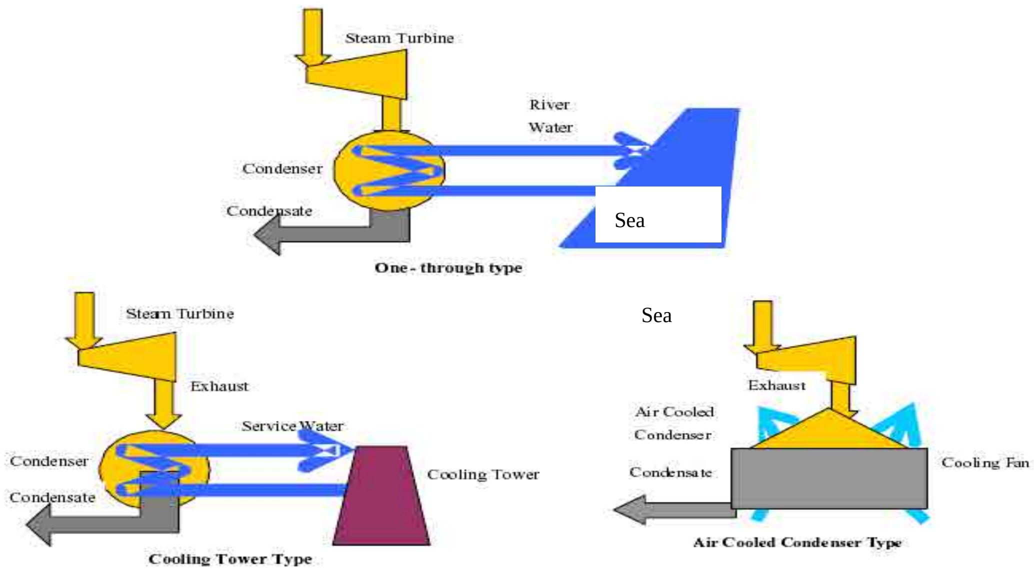


Figure 13.3-3 Three Method of Cooling System

Table 13.3-5 Comparison of Cooling System

Cooling methods	One-through method using sea water	cooling tower	Air cooled condenser
Types of cooling media	Sea water	Freshwater (River water or Underground water)	Air
Plant thermal efficiency	The best efficiency (Base)	Lower efficiency than One-through method (approximately - 0.3%)	The lowest efficiency (approximately -3%)

Thermal effluent	Generated	Hardly generated (generated when exchanging cooling water)	Not generated
Noise	The noise source is only the pumping equipment.	In addition to the pumping equipment, cooling fan makes loud noise.	In addition to the pumping equipment, cooling fan makes loud noise.

Source: Prepared by the survey team

13.4 Scoping and TOR of the Survey

13.4.1 Scoping Results

On the basis of the first local survey results, Table 13.4-1 lists environmental impact assessment items and impacts that are likely to occur due to the constructions and operation of the power plant (including of Access road).

Table 13.4-1 Scoping Result for Power Plant

No	Item	Assessment				Reasons of assessment
		Construction period		Operation period		
		Positive	Negativ	Positive	Negativ	
【Pollution control measure】						
1	Air pollution	N	B	N	A	**During construction:** - Civil engineering work, such as land formation, may cause dust, while heavy equipment and trucks are likely to discharge air pollutants (SOx, NOx, etc.). However, the scope of impacts from such pollutants will be limited to the vicinities of the construction areas. **During operation:** - Operation of the power plant will emit NOx.
2	Water pollution	N	B	N	A	**During construction:** - Muddy water will be generated during dredging work and land formation excavation. -During construction, domestic waste water and oil-containing waste water will be generated. However, the scope of impact will be limited to the vicinities of the work. **During operation:** - During operation, thermal water, plant wastewater, domestic waste water and oil-containing waste water will be generated.
3	Waste	N	B	N	B	**During construction:** - The construction work will generate general waste and hazardous waste. **During operation:** - General waste and hazardous waste will be generated.
4	Soil contamination	N	B	N	B	**During construction:** - Lubrication oil and fuel, etc. spilled from construction vehicles and construction machinery, etc. are likely to cause contamination in the soil. **During operation:** - Lubrication oil and fuel spilled during operation of the power plant are likely to cause contamination in the soil.
5	Noise and vibration	N	B	N	A	**During construction:** - Operation of heavy equipment and trucks will cause impact from the temporary noise and vibration. In particular, pile driving will cause impact

No	Item	Assessment: Construction period Positive	Assessment: Construction period Negativ	Assessment: Operation period Positive	Assessment: Operation period Negativ	Reasons of assessment
						from the strong noise and vibration into surrounding broader areas. **During operation:** - Operation of the plant will cause impact from the noise and vibration. Generally impact of vibration from the plant of gas turbine is smaller than noise.
6	Land subsidence	N	N	N	N	**During construction and operation:** - Water will not be drawn up from underground.
7	Odor	N	B	N	B	**During construction:** - If living waste at worker stations is handled improperly, the discarded waste may cause bad smell. **During operation:** - If living waste is handled improperly, the discarded waste may cause bad smell.
8	Substratum contamination	N	B	N	B	**During construction and operation:** - If untreated waste water is discharged, it will cause substratum contamination.
【Natural environment】						
1	Wild life preservation area	N	N	N	N	**During construction and operation:** - The site is located in no wild life preservation area and has no such nearby area.
2	Terrestrial ecosystems and rare species	N	C	N	C	**During construction:** - The site has a small sandy beach. Herbs and shrubs are scarce. Loss of habitat of animals and vegetation is expected. However similar environment extends into surrounding broad sandy beach areas. Limited impact on the ecosystems is expected. However, site survey will check the site for rare species, etc. - Construction work will generate air pollution, noise and vibration, etc. that will have impact on the terrestrial ecosystems. However, the range of such impact will be very limited. **During operation:** - The site has a small sandy beach. Herbs and shrubs are scarce. Loss of habitat of animals and vegetation is expected. However similar environment extends into surrounding broad sandy beach areas. Limited impact on the ecosystems is expected. However, site survey will check the site for rare species, etc. - Power plant will generate air pollution, noise and vibration, etc. that will have impact on the terrestrial ecosystems. However, the range of such impact will be very limited.
3	Marine ecosystems and rare species	N	C	N	C	**During construction:** - The dredging work for cooling water facilities and land reclamation are likely to generate muddy water. An official survey will check the site for impacts on rare species and other ecosystems. **During operation:** - Taking in organisms by cooling water intake, pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of Thermal water are expected to have impact on marine organisms. An official survey will check for the ecosystems including rare species.

No	Item	Assessment: Construction period, Positive	Assessment: Construction period, Negativ	Assessment: Operation period, Positive	Assessment: Operation period, Negativ	Reasons of assessment
4	River ecosystems	N	N	N	N	**During construction and operation:** - The site has no rivers inside.
5	River hydrology	N	N	N	N	**During construction and operation:** - The site has no nearby rivers. Water will not be drawn up from rivers.
6	Underground hydrology	N	N	N	N	**During construction and operation:** - Water from underground will not be drawn up during these operations.
7	Marine hydrology	N	N	N	B	**During construction:** - Since no port and harbor facilities will be constructed, there will be no change in flow conditions. **During operation:** - Because cooling water is taken from and discharged to sea, there will be changes in flow conditions in the vicinities of the discharged.
8	Topography and geology	N	N	N	N	**During construction and operation:** - Since the site has no port and harbor facilities, no change will take place in the coast.
【Social environment】						
1	Resettlement and Land acquisition	N	N	N	N	**During construction and operation:** - Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact.
2	Poor peoples	N	N	N	N	**During construction and operation:** - Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact.
3	Ethnic minorities	N	N	N	N	**During construction and operation:** - There is no minority group living around the project site.
4	Local economy including employment and means of livelihood	B	N	B	N	**During construction and operation:** - Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact. - Local people may be employed as workers by the power plant. It may purchase materials and equipment items in the local area.
5	Land use and utilization of local resources	N	N	N	N	**During construction and operation:** - Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact.
6	Water use	N	B	N	B	**During construction:** -There are few large ships at the sea with more shoals in front of the plant, where water depth gets 7m around 1.3km off the coast. -The fishing in front of the project site is prohibited. In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore. - Muddy water may be generated from dredging work and land reclamation and excavation work, resulting in impact on the recreational fishing. **During operation**： -There are few large ships at the sea with more shoals in front of the plant, where water depth gets 7m around 1.3km off the coast. -The fishing in front of the project site is prohibited. In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore. - Installation of water taking and discharging facilities and changes in flow

No	Item	Assessment				Reasons of assessment
		Construction period		Operation period		
		Positive	Negativ	Positive	Negativ	
						conditions may have impact on navigation of small boats of recreational fishing. - Taking organisms by cooling water intake, pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of Thermal water may cause impact on the recreational fishing.
7	Existing social infrastructure and social service	N	B	N	B	**During construction**: - Inflows of workers may need to build lodging houses, medical treatment facilities, sewer systems and other infrastructure. - Traffic during construction is expected to increase. **During operation:** - Lodging houses, medical treatment facilities, sewer systems and other infrastructure may be needed for workers.
8	Social bodies including society-related capitals and social organizations that make local decisions	N	N	N	N	**During construction and operation:** - Since the site is governmental land and not been used for farmland and residential area. Thus, it will foresee no relations with social bodies, such as local bodies that make decisions on matters including relocation of local people.
9	Unfair distribution of damage and benefit	N	B	N	B	**During construction and operation:** - If employing local people and/or outsourcing contracts are not fair, benefit may be unfairly distributed.
10	Conflict of interests within the local area	N	N	N	N	**During construction and operation:** - Since the site is governmental land and not been used for farmland and residential area, conflict of interests is not expected to take place within the local area.
11	Cultural heritage	N	N	N	N	**During construction and operation:** - Since the surroundings of the site have no historical, cultural and religious precious heritages, no impact is expected.
12	Scenery	N	N	N	N	**During construction and operation:** - Since the surroundings of the site have no scenic spots, no impact is expected.
13	Gender	N	N	N	N	**During construction and operation:** - No particular impact is expected to take place on the gender.
14	Rights of children	N	N	N	N	**During construction and operation:** - No particular impact is expected to take place on rights of children.
15	HIV/AIDS and other infectious diseases	N	B	N	N	**During construction:** - Inflows of foreign workers may spread such infectious diseases. **During construction:** - Inflows of foreign workers may be few.
16	Work environment (including labor safety)	N	B	N	B	**During construction and operation:** - Workers may have accidents during service. - Security guards may infringe on the security of surrounding people.
【Other】						
1	Accident	N	B	N	B	**During construction:** - Traffic accidents may occur during operation of vehicles. **During operation:**

No	Item	Assessment: Construction period: Positive	Assessment: Construction period: Negativ	Assessment: Operation period: Positive	Assessment: Operation period: Negativ	Reasons of assessment
						-Fire and Traffic accident by operation of facilities and/or vehicles.
2	Impact across the borders and on climatic change	N	B	N	B	**During construction:** - Although CO_2 is generated during construction, the impact is limited to a temporal period and not relatively large to take place across the borders and on climatic change. - Although Caspian Sea is an international lake, implementation of this project only requires procedures in accordance with Azerbaijan legislations and does not require procedures for neighboring nations. **During operation:** - Although operation of the power plant will generate CO_2, the CCPP system is efficient and CO_2 generation per kWh is smaller than the existing power plant. Thus, impact is hardly expected to take place across the borders and on climatic change. - Although Caspian Sea is an international lake, implementation of this project only requires procedures in accordance with Azerbaijan legislations and does not require procedures for neighboring nations.

Note) Categories are classified as follows:
A: There will be a serious impact.
B: There will be a certain impact.
C: The extent of impact will be uncertain. (A further survey will be needed to make the expected impact clear.)
N: Impact will hardly be expected.

13.4.2 TOR of Survey

On the basis of the above-mentioned scoping results, Table 13.4-2 lists necessary surveys, forecasts, and TOR for easing measures concerning environmental items with expected impact.

Table 13.4-2 Survey Items, Methods

Environmental item	Survey item	Survey method	Predictive assessment and mitigation measure
Air pollution	- Related environmental standards - Meteorological information - Present situation of air pollution	- Obtaining air quality standards and exhaust fume standards - Obtaining meteorological data from neighboring meteorological office (temperature, humidity, wind direction, wind speed. etc.) - Checking existing measurement results of air pollutants in the atmosphere (SO_2, NO_2, PM_{10}, etc.) and making field surveys	- During construction, the project will take air pollution control measures. - During operation, the project will satisfy the exhaust fume standards. - During operation, the project will simulate atmospheric diffusion of exhaust fume to check the conformity to the environmental standards.
Water pollution and substratum	- Related environmental standards	- Obtaining water quality standards and waste water	- During construction, the project will take measures to control water

Environmental item	Survey item	Survey method	Predictive assessment and mitigation measure
contamination	- Submarine topography - Current flow conditions - Current conditions of water quality	standards - Sounding - Checking existing measurement results of flow conditions (flow direction, flow speed, etc.) and conducting local surveys when needed - Checking existing measurement results on seawater (temperature, salt content, COD, nutrient salt, etc.) and making field surveys	pollution. - Simulating diffusion of warm waste water to check for the range of the diffusion - The project will satisfy the respective discharge standards for living waste water and other waste water by installing waste water treatment facilities.
Waste and Odor	- Related standards	- Obtaining standards for waste handling.	- During construction and operation, the project will prepare respective plans to handle industrial waste and living waste.
Soil contamination	- Nothing in particular	- Nothing in particular	- During construction and operation, the project will take measures to control oil contamination.
Noise and vibration	- Related environmental standards - Current situations of noise and vibration	- Obtaining noise standards - Noise and vibration: Checking existing measurement results and making field surveys	- During construction and operation, the project will take respective measures to control noise and vibration. - Conducting noise simulation to compare with the noise standards
Terrestrial ecosystems and rare specie	- Living conditions of terrestrial plants, mammals, birds, reptiles, amphibians, etc.	- Checking existing document information and making field surveys	- If a living rare species is found in the site, the project will take measures, for example, transplanting.
Marine ecosystem and rare species	-Living conditions of seaweeds, benthic organism, and fishes, etc.	- Checking existing document information and making field surveys	-During construction, the project will take measures to control water pollution. - Conducting simulations of warm waste water diffusion and comparing the diffusion range with living conditions - Examining water take and discharge systems - The project will satisfy the discharge standards for living water and other waste water.
Marine hydrology	- Submarine topography - Current flow conditions - Operating conditions of fishing boats	- Checking existing measurement results of flowage surveys (flow direction, flow speed, etc.) and making field surveys	- Comparing water discharge rates and streams in the sea area - Conducting flow simulations if many fishing boats, etc. sail.
Local economy including	- Current situations of jobs and livelihood	- Collecting material on situations of employment	- Preparing a local employment plan

Environmental item	Survey item	Survey method	Predictive assessment and mitigation measure
employment and means of livelihood	- Local economic development programs	and income in the area	
Water use	- Current situations of fishing and marine traffic	- Collecting material on the situations of fishing operation	- During construction, the project will take measure to control water pollution. - Conducing diffusion simulations of warm waste water and compare the range of the diffusion with living situations of fishes. - Examining water take and discharge systems - The project will satisfy the discharge standards for living waste water and other waste water.
Existing social infrastructure and social service	- Current situations of land use - Current situations of roads - Current situations of infrastructure facilities	- Collecting material on the situations of roads - Collecting material on infrastructure facilities	- Studying on a camping plan during construction and a plan to construct company houses - Preparing a plan to ease traffic accidents
Unfair distribution of loss and benefit	- Current situations of jobs and livelihood in the surrounding areas - Local economic development program	- Collecting material on the situations of employment and income	− Preparing fair employment standards
Scenery	- Current situations of scenic spots	- Collecting information on scenic spots	- If the project is likely to cause impact to a scenic spot, the project will take measures to ease the impact.
HIV/AIDS and other infectious diseases	- Nothing in particular	- Nothing in particular	- During construction, the project will prepare a labor and sanitation program.
Work environment (including labor safety)	- Nothing in particular	- Nothing in particular	- During construction and operation, the project will prepare respective labor and safety programs.
Accident	- Nothing in particular	- Nothing in particular	- During construction, the project will prepare measures to avoid Traffic accidents. - During operation, the project will prepare firefighting plan.
Impact across the borders and on climatic change	- Estimating CO_2 generation volumes of the project	Estimating CO_2 generation volumes on the basis of fuel consumption volumes	- During construction, the project will take measures to reduce CO_2 generation volumes. - During operation, the project will monitor CO_2 generation volumes.

13.5 The Result of Survey

13.5.1 Air Quality

1) Document survey

There are two main sources of emission near the project site: transportation and oil-and-gas industry such as popping superfluous gas and oil refining plants. In 2000, industrial emissions declined while emissions from traffic doubled.

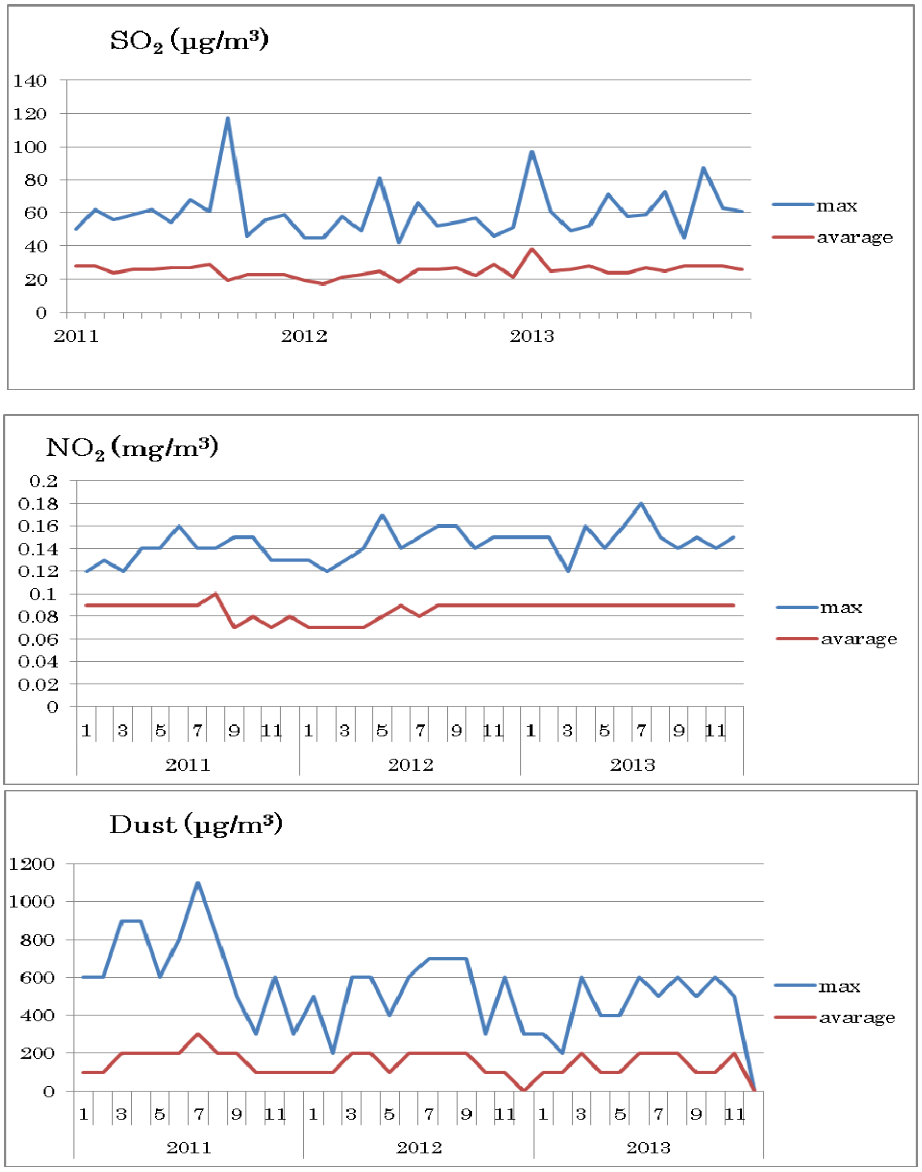
Figure13.5-1 shows the measured average and maximum value of three elements between 2011 and 2013: SO_2, NO_2 and dust, respectively.

As stated in 13.2.4, the results of the survey were compared with the environmental standard of EU and the IFC/WB Guidelines since the MAC standards in Azerbaijan does not fit in the criteria for judgment of the existing conditions survey.

The monthly average of SO_2 ranges from 20 to 40 $\mu g/m^3$, which always exceeds annual average of the standard of EU (20 $\mu g/m^3$).

The monthly average of NO_2 ranges from 70 to 100 $\mu g/m^3$, which always exceeds annual average of the standards of IFC/WB Guidelines (40 $\mu g/m^3$), as well.

The monthly average of dust is between 0 and 300 $\mu g/m^3$, which is mostly above the annual average of the IFC/WB Guidelines and EU standards (70 $\mu g/m^3$).



Substances	IFC/WB EHS guidelines (general)	EU Standards (Japanese Standards)
SO_2	500(10 min) 125(24hour) -	350(260)(1hr) 125(200)(24hr) 20(Yearly)
NO_2	200(1-hour) - 40(Yearly)	200(1hr) (75-110)(24hr) 40(Yearly)
Dust(PM_{10})	- 150(24hr) 70(Yearly)	(200)(1hr) 150(100)(24hr) 70(Yearly)

Figure13.5-1 Air Quality Measured in Sumgayit from 2011 to 2013

Field survey

The field survey of air quality and noise, which should be conducted for 24 consecutive hours, was carried out in spring. Another field survey in winter was not undertaken due to its severe meteorological condition. Fluctuation of survey results on air quality can be considered to be limited because spreading area of air-pollution substance are dependent on the wind direction and both north and south winds are prevailing throughout a year in this region.

In the project site and around residential area were selected as the sampling points for air quality and noise measurement (Figure 13.5-2). The survey was conducted in 13th of May, 2014 with interval of 1hr for 1 day. These results are presented in Table 13.5-1 and Table 13.5-2.

(Source: Study Team)

Figure 13.5-2 Sampling Points of Air Quality Survey

Background concentration of SO_2 is 22 – 27 μg/m^3 at the site and 32 – 42 μg/m^3 at the south side of residential area. This adequately meets the 10-minutes values （500μg/m^3） in IFC/WB EHS Guidelines and the values for an hour（500μg/m^3） in EU standards.

For 24 hours values, 24μg/m^3 at the site and 36μg/m^{3}at the south side of residential area respectively were measured, which fully satisfies EHS Guideline of IFC/WB and the environmental standard of EU.

Background concentration of NO_2 are 50 - 70 μ g/m^3 at the site and 60 – 100 μ g/m^3 at the south side of residential area, which fulfills an hour value of IFC/WB EHS Guidelines and standards of EU(200μg/m^3）.

For 24 hours values, 60μg/m^3 at the site and 83μg/m^{3}at the south side of residential area respectively were measure. This figures fit in the 24-hour values in Japanese environmental standards (75-110μg/m^3).

Background concentration of Dust are 100 μ g/m^3 at the site and 100 - 200 μ g/m^3 at the south side of residential area, which satisfies one-hour values in Japanese standards (200μg/m^3).

For 24 hours values, 100μg/m^3 at the site and 139μg/m^{3}at the south side of residential area respectively were measured, which meets 24-hour values of IFC/WB EHS Guidelines and standards of EU (150μg/m^3).

Table 13.5-1 Measure Results for Air Quality at the Site

Parameter	Unit	Project site			IFC/WB guideline (General: 2007)	EU Standards (Japanese Standards) (μg/m^3)
		Min	Max	Average (24hr)		
Sulfur dioxides (SO_2)	μg/m^3	22	27	24	500(10 min) 125(24hour) -	350(260)(1hr) 125(200)(24hr) 20(Yearly)
Nitrogen dioxides (NO_2)	μg/m^3	50	70	60	200(1-hour) - 40(Yearly)	200(1hr) (75-110)(24hr) 40(Yearly)
Dust	μg/m^3	100	100	100	- 150(24hr) 70(Yearly)	(200)(1hr) 150(100)(24hr) 70(Yearly)

Reference: Environmental performance reviews, United Nations 2010 and IFC/WB Environmental, Health, and Safety (EHS) Guidelines General, 2007

Table 13.5-2 Measure Results for Air Quality at the Residential Area

Parameter	Unit	Residential area			IFC guideline (General: 2007)	EU Standards (Japanese Standards)
		Min	Max	Average (24hr)		
Sulfur dioxides (SO_2)	μg/m^3	32	42	36	500(10 min) 125(24hour) -	350(260)(1hr) 125(200)(24hr) 20(Yearly)
Nitrogen dioxides (NO^2)	μg/m^3	60	100	83	200(1-hour) - 40(Yearly)	200(1hr) (75-110)(24hr) 40(Yearly)
Dust	μg/m^3	100	200	139	- 150(24hr) 70(Yearly)	(200)(1hr) 150(100)(24hr) 70(Yearly)

Reference: Environmental performance reviews, United Nations 2010 and IFC/WB Environmental, Health, and Safety (EHS) Guidelines General, 2007

13.5.2 Sea Water Quality

Table 13.5-3 reveals the recent situation of the sea water quality in Sumgayit. Compared with MAC of Azerbaijan, many elements had exceeded their MAC for three years. Above all, significantly high figures were measured in iron from 8.8 to 12.0mg/l in spite of 0.05mg/l in its MAC. The only substance which was below its MAC was cadmium.

Table 13.5-3 Sea Water Quality Measured in Sumgayit from 2011 to 2013

Element	Unit	2011		2012		2013		Azerbaijan water quality standard (MAC)
		MAX	MIN	MAX	MIN	MAX	MIN	
pH	-	8.5	8.27	8.52	8.4	8.5	8.4	6.5~8.5
Dissolved oxygen (DO)	mg/l	10.53	9.43	10.45	9.46	10.45	9.46	>4.0-6.0
COD	mg/l	6.9	4.8	5.8	4.25	6.7	4.9	125
Oil and Grease	mg/l	0.18	0.01	0.17	0.08	0.13	0.015	0.05
Phenol	mg/l	0.14	0.06	0.13	0.07	0.12	0.06	0.001
Cd	mg/l	0.002	0.001	0.001	0.001	0.002	0.001	0.005
Cu	mg/l	0.039	0.020	0.024	0.015	0.028	0.017	0.01
Fe	mg/l	11.3	8.9	10.3	8.8	12.0	9.5	0.05
Mn	mg/l	0.111	0.082	0.120	0.089	0.101	0.079	0.1
Ni	mg/l	0.022	0.012	0.024	0.012	0.022	0.015	0.01
Zn	mg/l	0.025	0.015	0.029	0.010	0.025	0.013	0.01
Co	mg/l	0.010	0.007	0.012	0.006	0.012	0.009	0.01

Field survey

Only small boats were available for the survey of water quality, marine water flow, and marine flora and fauna because no one is engaged in fishery near the project site.

However, strong wind and turbulent waves around there in winter made it impossible to conduct survey by small boats.

Therefore, the field survey on water quality, marine water flow, and marine flora and fauna were carried out at the sea area facing the site in spring when the sea is calm.

The intake point of cooling water and coastal facing area of site were selected as the sampling points (Figure 13.5-3). The survey was conducted in 13th of May 2014.

Water quality data is shown in Table 13.5-4 added ambient sea water quality standards.

According to the site results, most of values satisfy the environmental standard of Azerbaijan.

However, values of Suspended Solids (SS) and Zink exceed the environmental standard.

(Source: Study Team)

Figure 13.5-3 Sampling Points of Sea Water Quality Survey

Table 13.5-4 Water Quality Measure Result

Item	Unit	Environmental Standard of Azerbaijan (MAC)	Intake Point			Offshore Point from the Outlet Point		Nearby Outlet		
			Surface layer	Middle layer	Lower layer	Surface layer	Lower layer	50 meter left from center	Center of outlet	50 meter right from center
Temperature	°C	-	19.9-20.9	18.9-20.0	18.7-19.7	22.1-23.2	-	-	-	-
pH		6.5-8.5	8.19	8.18	8.18	8.19	8.18	8.19	8.22	8.24
DO	mg/L	>4.0-6.0	5.64	5.52	5.29	5.4	5.34	4.99	4,97	4.94
BOD	mg/L	25	7	7.3	8	10	11	8	9	12
COD	mg/L	125	16	15.4	15	24	20	13	17	26
SS	mg/L	30	6	5.4	5	11	10.1	**84**	**54**	**49**
Cadmium (Cd)	mg/L	0.005	0.00006	0.00006	<0.00002	0.00002	0.00003	0.00004	0.00004	0.00004
Chromium (Cr)	mg/L	0.005	00001	0.0001	0.0002	0.0002	0.0002	0.0003	0.0003	0.00003
Copper (Cu)	mg/L	0.01	0.006	0.007	0.002	0.005	0.005	0.0002	0.002	0.002
Iron (Fe)	mg/L	0.05	0.002	0.002	0.003	0.002	0.002	0.003	0.004	0.004
Lead (Pb)	mg/L	0.1	0.001	0.001	0.00009	0.0003	0.0004	0.00004	0.00004	0.00004
Mercury (Hg)	mg/L	0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel (Ni)	mg/L	0.01	0.001	0.001	0.0001	0.001	0.001	0.003	0.003	0.003
Zinc (Zn)	mg/L	0.01	**0.02**	**0.02**	0.00095	0.004	0.004	0.001	0.001	0.001

13.5.3 Sea Bottom Sediment

The table13.5-5 shows the maximum allowable concentration (MAC) of elements in Caspian Sea bottom and measured data of sea bottom sediment in Sumgayit between 2011 and 2013, respectively.

Most elements remain below their MAC, though the measurement found frequent excess of zinc, manganese and Iron over its MAC.

These elements may be naturally sourced from soil and geology surrounding of the Caspian Sea.

Table 13.5-5 Sea Bottom Sediment Measured in Sumgayit from 2011 to 2013

Element	Unit	2011		2012		2013		MAC
		MAX	MIN	MAX	MIN	MAX	MIN	
Oil	mg/g	0.1	0.009	**0.8**	0.05	0.11	0.011	0.5
Phenols	mg/g	ND	ND	ND	ND	ND	ND	0.01
Zn	μ g/g	**160.6**	97.4	**156.9**	107.4	**160.6**	97.4	100
Cu	μ g/g	19.6	8.45	17.6	8.7	17.6	8.5	100
Ni	μ g/g	24.95	16.1	21.9	15.5	22.9	15.5	100
Mn	μ g/g	**283.3**	**176.85**	**272.9**	**172.7**	**283.3**	**176.85**	100
Co	μ g/g	5.55	1.85	5.55	1.85	5.5	2.45	100
Fe	μ g/g	**7115**	**3236.8**	**6431.9**	**2873.2**	**6369.9**	**2913.5**	500
Cd	μ g/g	ND	ND	ND	ND	ND	ND	50

13.5.4 Noise

The project site and around residential area were selected as the sampling points for Noise measurement (Figure 13.5-4). The survey was conducted in 13th of May 2014 with interval of 1hr for 1 day.

Noise levels during daytime at the site is 28 -38(dBA) and at the south of the residential area is 39 -54(dBA) respectively, which fully satisfies the environmental standard of Azerbaijan and EHS Guideline of IFC/WB.

Noise level during night time at the site is 25 - 29(dBA) and at the south side of the residential area is 37 - 44 (dBA), which fully satisfies the environmental standard of Azerbaijan and EHS Guideline of IFC/WB.

(Source: Study Team)

Figure 13.5-4 Sampling Points of Noise Measurement Survey

Table 13.5-6 Noise Measure Result (Leq)

Survey date: 13th May 2014

Sampling Point	Time Day: 7:00-23:00 Night: 23:00-7:00	Noise level (Leq: dBA) Min	Max	Average	Noise standard of Azerbaijan (Leq: dBA)	IFC/WB EHS guidelines（General） (Leq: dBA)
Project site	Daytime	28	38	34	Industrial area: 65	Industrial area: 70
	Nighttime	25	29	26	Industrial area: 55	Industrial area: 70
Residential Area	Daytime	39	54	47	Residential Area: 60	Residential area: 55
	Nighttime	37	44	40	Residential Area: 45	Residential area: 45

13.5.5 Terrestrial Flora and Fauna

In order to obtain data on inhabiting condition of land flora and fauna as much as possible during the limited research period, the field survey was conducted in spring when plants are luxuriant and the kinds of animals are abundant due to plenty precipitation and relatively high temperature.

Winter is severe condition for flora and fauna to live as temperature is low and wind is strong, in the project site which is no trees, no river and flat land.

Spring is also the season when migratory birds move to this area and start building their nests. Furthermore, the fact that it is semi-desert areas within and around the site is taken into account.

Existing literature was reviewed for the purpose of supplement because the field survey was conducted only during the limited period.

(1) Terrestrial Flora

Most of Area around the thermal power plant including transmission line and gas pipeline are semi-desert area. The area is very dry, most part of soil is very salty and the flora is not rich.

According to the existing documents, as flora, inhabitants of *Convolvulus persicus*, *Atriplex fomini*, *Juncus littoralis*, *J.acutus*, *Atropis gigantean*, *Calamagrostis gigantean*, *Agropyron elongatum*, *Acorellus pannonicus*, *Melilotus caspius* etc. are recorded in the sandy beach zone like the power plant project site.

Regarding flora in the land-side of the beach, *Agriophyllum arenartum*, *Artemisia arenaria*, *Elymus giganteus*, *Astragalus hyrcanus*, *Centaurea arenaria*, *Convolvulus erinaceus*, *Colligonum bakuense*, *C.petunnikowii*, *Artemisia scoparia* and *Scabiosa ucrainica* etc. are recorded.

According to the red list of Azerbaijan, one species is recorded as 'Near Threatened'; three species are recorded as 'Vulnerable'. One of these species are categorized as target species of CITES however, there is no species recorded as precious species in IUCN.

Investigation of terrestrial flora and fauna (Amphibians, Reptiles, Birds, and Mammals) was conducted since 19th to 22nd of May 2014 at 2 points around the site of the power plant (Figure 13.5-5).

(Source: Study Team)

Figure 13.5-5 Survey Area of Terrestrial Flora and Fauna (Amphibian, Reptile, Bird and Mammal)

The table 13.5-7 shows the list of flora species observed around the project site (No.1 and No.2). 19 flora species were observed around the power plant project site during the site survey. No species is designated under Azerbaijan Red Book, IUCN Red List, nor CITES.

Table 13.5-7 Species of Flora in the Power Plant Site

Number	English name	Latin name	Project site No.1	Project site No.2	Azerbaijan Red Book	IUCN	CITES
1	Mediterranean hair grass	*Rostraria cristata*		●	-	-	-
2	Bulbous bluegrass	*Poa bulbosa*		●	-	-	-
3	Red anisantha	*Anisantha rubens*		●	-	-	-
4	Tufted grass	*Lolium rigidum*		●	-	-	-
5	Wheat eremopyrum	*Eremopyrum triticeum*		●	-	-	-
6	Wall barley	*Hordeum leporinum*		●	-	-	-
7	Coville's rush	*Juncus macrantherus*	●		-	-	-
8	Saltbush	*Atriplex fominii*	●		-	-	-
9	Tree glasswort	*Salsola dendroides*		●	-	-	-
10	Lucern	*Medicago minima*		●	-	-	-
11	Locoweed	*Astragalus igniarius*	●		-	-	-
12	Cut-leaved Cranesbill	*Geranium dissectum*		●	-	-	-
13	Bindweed	*Convolvulus persicus*	●		-	-	-
14	Siberian sea rosemary	*Argusia sibirica*	●		-	-	-
15	Fleawort	*Plantago notata*		●	-	-	-
16	Broad-leaved cudweed	*Filago pyramidata*		●	-	-	-
17	Ordered wormwood	*Artemisia marshalliana*	●		-	-	-
18	Clasping pepperweed	*Lepidium perfoliatum*		●	-	-	-
19	Neotorularia	*Neotorularia contortuplicata*		●	-	-	-

(Source: Study Team)

(2) Terrestrial Fauna

1) Amphibian and Reptile

According to the existing documents, as Amphibian, inhabitants of two species are recorded and 21 species are recorded as Reptiles around the power plant project site.

According to the red list of Azerbaijan, one species is recorded as 'Vulnerable'. Of these species, two species are targeted in CITES and one species is categorized as 'Vulnerable', one species as 'Near Threatened' and five species as 'Least Concern' in red list of IUCN respectively.

The site survey was conducted from 19th to 22nd of May 2014 at 3 points around the site of the power plant.

According to the site survey result, fauna covered by the Azerbaijan Red List are not observed.

Additionally, this survey does not find precious species which are targeted by CITES and which are categorized into 'Endangered', 'Vulnerable', 'Near Threatened' of IUCN.

One species of Amphibian (*Pelophylax ridibundus*), which is categorized as 'Least Concern' of IUCN Red List, was observed at survey point No.1.

With regards to Reptile, *Lacerta strigata*, which is 'Least Concern' under IUCN Red List, was observed at the survey point No.1 and No.2

2) Bird

According to the existing documents, as birds, inhabitants of no less than 159 species are recorded around the power plant project site. Among the birds 39 species nest, 27 species appear in the winter, 81 are over-migrate, and 8 can be seen occasionally in the area.

According to the red list of Azerbaijan, one species is recorded as 'Endangered', one species as 'Near Threatened' and 11 species as 'Least Concern' is recorded respectively. Of these species, 15 species are targeted in CITES and one species is categorized as 'Critically Endangered', two species as 'Endangered' two species as 'Vulnerable', five species as 'Near Threatened' and 115 species as 'Least Concern' are categorized in red list of IUCN respectively.

The site survey was conducted from 19th to 22th of May 2014 at 3 points around the site of the power plant.

The table 13.5-8 shows the species of Birds observed in the project site.

18 species were observed around the power plant site at either No.1 or No.2 survey point. However, they are not covered by Azerbaijan Red List.

Additionally, this site survey does not find any precious species which are targeted by CITES and which are categorized into 'Endangered', 'Vulnerable' and 'Near Threatened' of IUCN.

All of the species are categorized as 'Least Concern', according to the IUCN Red List.

Table 13.5-8 Species of Birds in the Power Plant Site

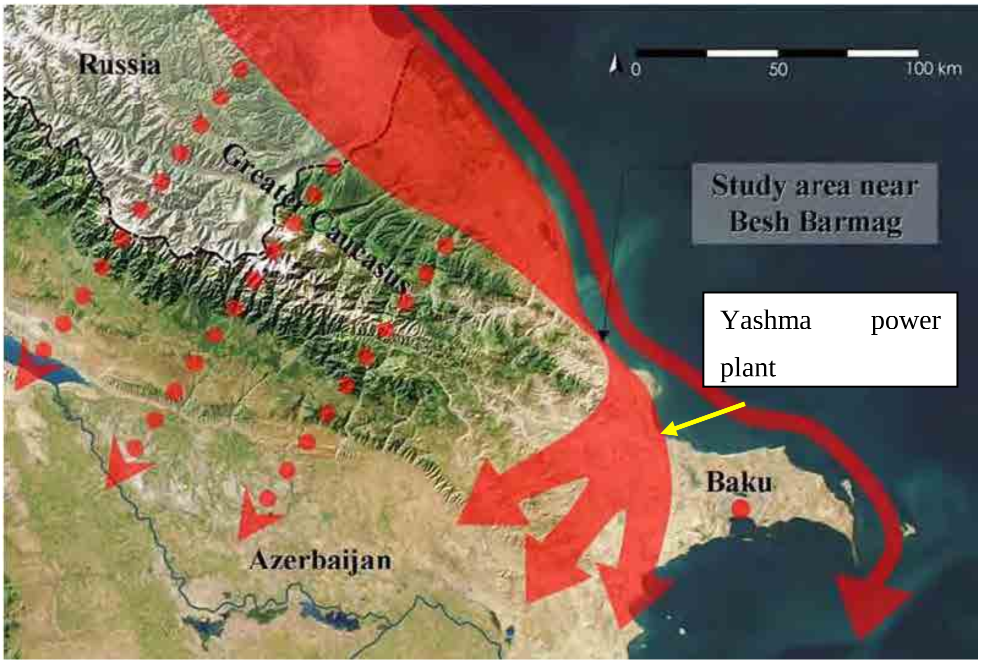
No.	English name	Latin name	Project site No.1	Project site No.2	Azerbaijan Red Book	IUCN	CITES
1	House sparrow	*Passer domesticus*	●		-	Least Concern	-
2	Carrion crow	*Corvus corone*		●	-	Least Concern	-
3	Rock dove or feral pigeon	*Columba livia*	●		-	Least Concern	-
4	Blackbird	*Turdus merula*		●	-	Least Concern	-
5	Sky lark	*Alauda arvensis*		●	-	Least Concern	-
6	Crested lark	*Galerida cristata*	●	●	-	Least Concern	-
7	Desert wheater	*Oenanthe deserti*	●	●	-	Least Concern	-
8	Isabelline wheater	*Oenanthe isabellina*	●	●	-	Least Concern	-
9	Marsh warbler	*Acrocephalus palustris*	●		-	Least Concern	-
10	Little tern	*Sterna albifrons*	●		-	Least Concern	-
11	Sandwich tern	*Sterna sandvicensis*	●		-	Least Concern	-
12	Swallow	*Hirundo rustica*	●		-	Least Concern	-
13	Kestrel	*Falco tinnunculus*	●		-	Least Concern	-
14	Magpie	*Pica pica*		●	-	Least Concern	-
15	Little swift	*Apus affinis*		●	-	Least Concern	-
16	Swift	*Apus apus*	●	●	-	Least Concern	-
17	Herring gull	*Larus argentatus*	●		-	Least Concern	-
18	Bee eater	*Merops apiaster*		●	-	Least Concern	-

(Source: Study Team)

Among 18 species observed, 3 species *Alauda arvensis*, *Sterna albifrons* and *Hirundo rustica* are migratory birds.

According to the literature survey, migratory birds migrate from north, Russia or Eurasia to the south during autumn-winter period. Many of the migratory birds stay or stop over at wet lands or deltas of large rivers along the coast of Caspian Sea. The figure13.5-6 shows migration routes (red-color) around the project site for the migratory birds to take from Russia to the wetlands and deltas of Caspian Sea located south of Azerbaijan.

There is no wet land and large river around the project site and the project site is edge of migration routes.



*Broad red line: main migration route
*Narrow red line: coastal water bird migration route
*Dotted red line: minor migration route

Figure 13.5-6 Routes of Migration Birds (Heiss & Gauger, 2007)

2) Mammal

According to the existing documents, as Mammal, inhabitants of 20 species are recorded around the power plant project site. They can be classified into five groups; one species of Insectivore, six of Chiroptera, one of Logomorpha, eight of Rodentia, and four of Carnivora.

According to the red list of Azerbaijan, one species is recorded as ‘Endangered’, one species as ‘Vulnerable’ and one species as ‘Least Concern’ is recorded respectively. Of these species, three species are targeted in CITES and one species is categorized as ‘Endangered’, two species as two species as ‘Vulnerable’ and 17 species as ‘Least Concern’ are categorized in red list of IUCN respectively.

The site survey was conducted from 19th to 22nd of May 2014 at 3 points around the site of the power plant.

According to the site survey result, no mammal species were observed around the power plant site survey point (No.1 or No.2).

13.5.6 Marine Flora and Fauna

As mention in the survey of water quality, strong wind and turbulent waves around there in winter made it impossible to conduct survey by small boat.

In order to obtain data on inhabiting condition of marine flora and fauna as much as possible during the limited research period, the field survey was conducted in spring when the number of phytoplankton, marine plants, and benthos begin increasing due to relatively high water temperature.

Existing literature was reviewed for the purpose of supplement because the field survey was conducted only during the limited period.

(1) Marin Flora

a. Phyto-plankton

According to the existing documents, as Phyto-plankton, inhabitants of 225 species and subspecies are recorded at Caspian Sea in front of the power plant. They include 60 species of Cyanophyta, 90 of Bacillariophyta, 34 of Pyrrophyta, 4 of Euglenophyta, 37 of Chlorophyta. Only 18% of the phytoplankton has a marine origin, while the rest are freshwater water species. Therefore, the coastal area of the Middle Caspian, which consists of saline water, has a poor phytoplankton composition.

Phyto-plankton was observed in the intake area for cooling water and outlet for thermal discharge of the project shown in Figure 13.5-7. The survey was conducted in 15th to 16th of May 2014.

Figure 13.5-7 Survey Location (Phytoplankton)

The table 13.5-9 shows the species of Phyto-plankton observed in these points.

Around the marine area in the front of the power plant project site, 14 species were found at the intake point and 11 species were found at the coastal facing area (around water outlet area).

Table 13.5-9 Species of Phytoplankton in the Survey Points

Latin name	Intake point	coastal facing area
	No1	No.2
Cyanophyta		
Aphanizomen flos-aquae	+	+
Nodularia harveyana	+	
Bacillariophyta		
Actinocyclus ehrenbergii	+	
Rhizosolenia calcar-avis	+	+
Rhizosolenia fragissima	+	+
Thalassiosira variabilis	+	+
Chaetoceros subtilis	+	+
Chaetoceros wighamii	+	+
Thalassionema nitzshioides	+	+
Coscinodiscus radiatus	+	+
Sceletonema costatum	+	
Dinophyta		
Prorocentrum cordata	+	+
Goniaulax digitale	+	+
Goniaulax polyedra	+	

(Source: Study Team)

b. Sea grass

According to the existing documents, as Sea grass, inhabitants of 33 species of Chorophycophyta, 24 of Rhodophycophyta, and 13 of Phaeophycophytaare recorded at Caspian Sea in front of the power plant.

As Sea grass, *Zostera noltii* inhabits the coastal area of the Middle Caspian, which in places forms extensive areas. It usually grows at a depth of 1.5-5 m, mainly in the sand, sand-shell, and rarely in silt sediments

During marine biological research, on the coastal line, there are significant accumulations of *Zostera noltii* (Fig.13.5-8). *Zostera noltii* is removed by grazing or wave action during the winter and overwinters as a rhizome and shoot fragments, which enables recruitment and re-growth in the spring.

Zostera noltii is categorized as 'Least Concern' in red list of IUCN, but is not designated under Azerbaijan Red Book.

Figure13.5-8 Sea Grass on the Coastal Line

(2) Marine Fauna

a. Zoo-plankton

According to the existing documents, as Zoo-plankton, inhabitants of 189 species are recorded at Caspian Sea in front of the power plant. Among them, the most diverse are Infusoria (104 species) followed by Cladocera (36), Copepoda (23), Rotatoria (9), Mysidacea (6), Amphipoda (6), Cumacea (5). Other taxonomic groups are represented with 1-2 species.

Polyphemus exiguus, *Podonevadne trigona pusilla*, *P.trigona typica*, *P.camptonyx angusta*, *Evadne anonyx, Synchaeta vorax, S.neapolitana* are dominant species in zooplankton of the Middle Caspian, where they occur mostly in the coastal shallow water areas.

Zoo-plankton was observed in the intake area for cooling water and outlet for thermal discharge of the project shown in Figure 13.5-9. The survey was conducted in 15th to 16th of May 2014.

(Source: Study Team)

Figure 13.5-9 Survey Location (Zoo-plankton)

The table 13.5-10 shows the species of Zoo-plankton observed in these points.

Around the marine area in the front of the power plant project site, 17 species were found at the intake point and 14 species were found at the coastal facing area (around water outlet area).

Moreover, near the intake point fish eggs in the composition of the zooplankton presumably belong to the Caspian kilka (*Clupeonella caspia*), which in the end of spring and early summer spawns in shallow waters at the western part of the Middle Caspian Sea.

Table 13.5-10 Species of Phytoplankton in Survey Points

Latin name	Intake point	coastal facing area
	No.1	No.2
Hydrozoa		
Moerisia pallasi	+	
Scyphozoa		
Aurelia aurita	+	
Ctenophora		
Mnemiopsis leidyi	+	+
Cumacea		
Pterocuma pectinata	+	+
Stenocuma diastyloides	+	+
S. gracilis	+	
Amphipoda		
Pseudalibrotus caspius		+
Cladocera		

Latin name	Intake point	coastal facing area
	No.1	No.2
Polyphemus exiguus	+	+
Cercopagus prolongata	+	+
C. socialis		+
Pleopis polyphemoides	+	
Evadne anonyx	+	+
Podonevadne trigona	+	
Copepoda		
Limnocalanus grimaldii	+	+
Calanipeda aquae-dulcis	+	+
Eurytemora grimmi	+	+
E. minor	+	+
Halicyclops sarci	+	
Acartia clausi	+	+

(Source: Study Team)

b. Macro Benthos

According to the existing documents, as Macro Benthos, inhabitants of 112 species are recorded at Caspian Sea in front of the power plant. Mollusks constitute 95.3% of total zoobenthos biomass; among mollusks the most developed are *Mytilaster lineatus* and *Abra ovata*. Both these species have been introduced into the Caspian from the Black sea.

Macro Benthos was observed in the intake area for cooling water and outlet for thermal discharge of the project shown in Figure 13.5-10.

(Source: Study Team)

Figure 13.5-10 Survey Location (Macro Benthos)

The table 13.5-11 shows the species of Macro benthos observed in these points.
Around the marine area in the front of the power plant project site, 12 species were found at the intake point and 8 species were found at the coastal facing area (around water outlet area).

Table 13.5-11 Species of Macro Benthos in the Survey Points

Latin name	Intake point	coastal facing area
Cordylophora caspia	+	
Nereis diversicolor	+	+
Conopeum seurati	+	
Cerastoderma rhomboids	+	+
Abra ovate	+	
Didacna pyramidata	+	+
Mytilaster lineatus		+
Balanus improvises	+	+
Schizhorynchus eudorelloides	+	+
Stenicuma diastiloides	+	
Pontoporeia affinis	+	+
Pontogammarus meoticus	+	
Niphargoides compressus		+
Rhithropanopeus harrisii	+	

(Source: Study Team)

(3) Fish

According to the existing documents, as Fishes, inhabitants of 62 species which consist of 10 families described below are recorded at Caspian Sea in front of the power plant.
10 families are explained here. First of all, four species belong to family STURGEONS. One of them, *Acipenser nudiventris derjavini* is designated in Red Book of Azerbaijan (Fauna, 2013). Secondly, nine species are in the family CLUPEIDS which is represented with two genus; Clupeonella (kilka) and Alosa (shad). Thirdly, three species are grouped into the family SALMONIDS. Caspian salmon (*Salmo trutta caspius*) is listed in the Red Book of Azerbaijan (Fauna, 2013). Fourthly, 12 species are in the family CYPRINIDS, three of which are on the Red Book of Azerbaijan; Chanari barbel (*Barbus capito*), Caspian barbell (*B. brachycephalus caspius*), and White-eyed bream (*Abramis.sapa bergi*). One species in the family EELS, one in the PIPEFISHES two in the MULLETS, one in the SILVERSIDES and 26 in the GOBIIDS are identified in the Caspian. Lastly, sea zander (Sander marina) in the PERCHES is included in the Red Book of Azerbaijan. In addition to these, among invertebrates inhabiting in the Middle

Caspian, three species are used as food.

The biology of Red Data Species stated above is outlined in a following table. These species, which range from river to the sea, move from the sea to rivers and estuaries to lay eggs and grow up around the area where a river meets the sea.

There is no river flowing throughout a year around 30km of the site. Therefore, the sea area in front of the site cannot be considered as important habitats of these species.

Table 13.5-12 Biology of Red Data Fish in Azerbaijan

Red Data fish	Outline of biology
Acipenser nudiventris derjavini	Lay eggs in rivers in spring. Juvenile fish grow up in rivers for 2-8 years and move to the sea. Basically, occur in blackish waters, where a river meets the sea, and the sea. Run to the river to lay eggs at 6-18 ages. This fish is observed largely in the middle Caspian and South Caspian sea and hardly observed in the North Caspian sea.
Salmo trutta caspius	Lay eggs in rivers in autumn. Some juvenile fish move to the sea in spring and others stay in rivers. This fish is prefers to live in the South, West and South West of the Caspian sea
Barbus capito	Feed themselves mainly around estuaries. Move to side streams in the end of summer or autumn and lay eggs. This fish distribute in river basin of the Southern and Western Caspian sea
Barbus. brachycephalus caspius	Lay eggs in rivers and around estuaries from the end of April to the end of August. Become adult fish at 6-8 ages. This fish distribute in river basin of the Southern and Western Caspian sea
Abramis.saa bergi	Occur in blackish waters in downriver and estuaries. Lay eggs on underside of locks and waterweed in rivers flowing fast. This fish distribute in the Southern and Western Caspian sea
Sander marina	Occur in rivers and the sea whose salinity is 1~2ppt and can be often observed near estuaries and in downstream. Lay eggs in estuaries in July and August. Eggs hatch 2 or 3 days later. This fish is founded in All Caspian sea

During marine biological research, six species were found, and hearing investigation was also conducted.

The table 13.5-13 shows the species of Fish and Megalobenthos observed in the project site and recorded in the surrounding area.

Table 13.5-13 Species of Fish in the Power Plant Site

English name	Latin name	coastal facing area	IUCN	Azerbaijan Red Book	CITEC
Caspian shad	*Alosa caspia*	+	Least Concern		
Caspian roach	*Rutilus caspicus*	+	Least Concern		
Golden mullet	*Liza auratus*	+			
Leaping gray mullet	*L. saliens.*	+			
Caspian round goby	*Neogobius melanostomus affinis*	+			
Bighead goby	*N.kesslery gorlap*	+			
Black-back shad	*A.kessleri kessleri*				
Kutum	*R.frisii kutum*				
Eastern bream	*Abramis brama orientalis*				
Common carp	*Cyprinus carpio*				
Deep-water goby	*Neogobius bathybius*				

(Source: Study Team)

c. Marine mammal

According to the existing documents, Caspian Seal (*Phoca caspica*) concentrates in the North Caspian, where mating, breeding and molting take place in the autumn-winter period, and spreads over the feeding areas in the northern part of the Middle Caspian where includes the area near the power station.

The field survey found Caspian Seal at about 100m offshore from the intake point.

Caspian Seal is categorized as ‘Endangered’ in red list of Azerbaijan and IUCN.

13.5.7 Marine Hydrology

Current direction and speed were observed in the locations in the intake point of cooling water and coastal facing area of site (Figure 13.5-11). The survey was conducted in 8th to 15th of May 201 with interval of 1hr.

Since existing literatures report the currents around the project site are influenced by the winds, wind direction and speed were also measured at the same time of the observation of current direction and speed.

(Source: Study Team)

Figure 13.5-11 Survey Points of Current

The observed results of current direction and speed is shown in Figure 13.5-12.

During the observation period, southeast streams are prevailing along the coast due to the northwest winds. Current speed were mostly from 30 to 60cm/s.

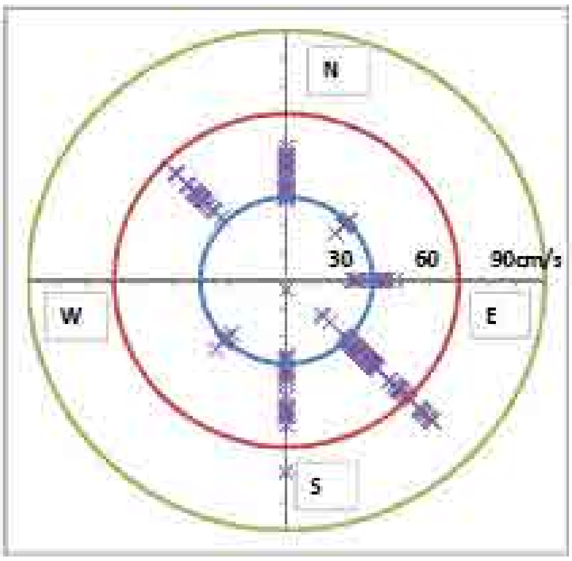
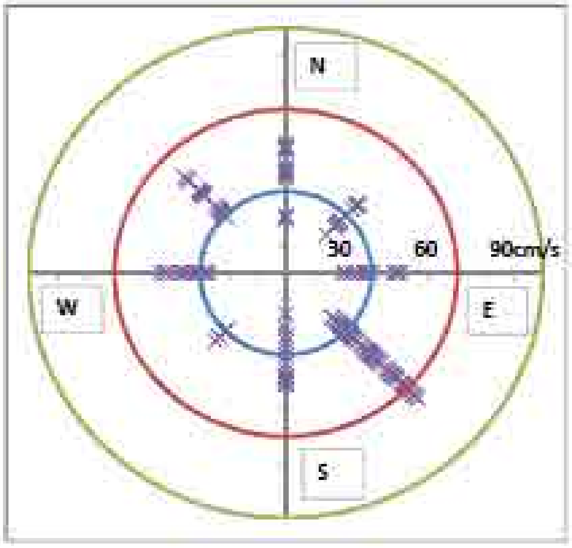
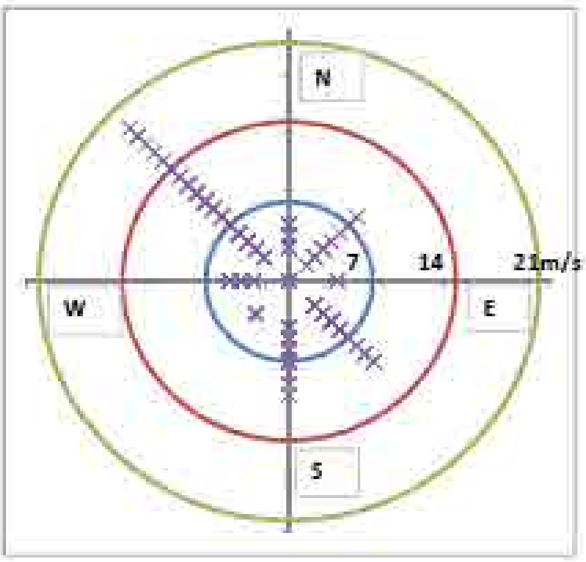
<table>
<tr><td colspan="2">（Current direction and speed）</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Near intake point</td><td>Near dischage point</td></tr>
<tr><td colspan="2">（Wind direction and speed）</td></tr>
<tr><td colspan="2">
</td></tr>
</table>

Figure 13.5-12 Current Rose

13.6 Environmental Impact Evaluation

13.6.1 Construction Phase

(1) Pollution

1) Air quality

Generation of dust is expected by land preparation, and generation of air pollutants (SOx and NOx, etc.) is predicted from the operation of heavy machinery and trucks, but the impact will be limited only to the surrounding area.

According to the Beaufort scale, when wind speed exceeds about 6 m/s, dust on the ground may be lifted up. The occurrence ratio of wind speed exceeding about 6 m/s around the project site is very high, above 35 %.

With the observation of dust caused by the strong winds, periodic watering of the site and road, covering of the soil-transport trucks and periodic car wash covering will be conducted to reduce dust generation.

Periodic maintenance and management of all the construction machinery and vehicles will be conducted to reduce exhaust gas discharged from construction machinery and vehicles.

2) Water quality

Muddy water will be generated during dredging work and land formation excavation. Domestic waste water and oil-containing waste water will be generated.

Temporary rainwater drainage, sedimentation pond will be installed around the construction area. Its surface water shall be discharged to the Caspian Sea after the sedimentation treatment.

In case dredging is conducted on installing intake equipment, the use of the silt fence or sheet and of pump dredgers with less turbidity generation will be considered in order to minimize turbidity.

A wastewater treatment facility for workers, such as a septic tank and temporary toilet, an oil separator for oily run-off water, will be installed in the worker’s camp and construction area.

These measures will minimize the impact of contamination of sea water.

3) Waste

Waste generated from the construction work will include metal chips, waste plastic, wood shavings, waste glass and waste oil. Furthermore, household waste discarded from the camping site of the workers will include cans, bottles and garbage. If such waste is inadequately handled, sea water may be contaminated, and sanitation problems may arise.

Development of waste management program including education of workers to encourage reduction and reuse of waste will be promoted.

Non-recyclable and hazardous waste will be stored and disposed at appropriate sites according to related regulations. To reduce the amount of solid waste discharged from the workers in camping site, efforts will be taken to employ local workers as many as possible, so that the amount of household waste at the plant will be minimized.
Specifically, paper wastes and iron scraps will be recycled. Other general wastes will be collected by Sumgayit city and carried to existing disposal fields.
All of the hazardous waste will be disposed by a waste management company approved by the government at disposal fields in Sumgayit which are permitted by the government in accordance with the Azerbaijan legislation.

These measures will be taken to ensure that water pollution or sanitary problems resulting from waste will not arise.

4) Soil contamination
Soil pollution will possibly be caused by leakages of oil and chemical materials at the construction site. Oil and chemical materials will be stored at installed appropriate storage place in the project site to prevent any permeation into the ground. These measures will minimize the impact of any soil contamination.

5) Noise and Vibration
<Noise>
Operation of heavy equipment and trucks will cause impact from the temporary noise. In particular, pile driving will cause impact from the strong noise into surrounding broader areas. There is some house of residence located near the project site, and sufficient consideration must be given to minimizing any noise impact.

The level of noise resulting from the operation of the construction machinery was simulated using the following estimation model.

Noise level estimation model
Noise predictions were carried out accordance to International Standard ISO 9613, Acoustics-Attenuation of Sound during Propagation Outdoor.
The ISO Propagation model calculates the predicted sound pressure level by taking the source power level for equipment in separate octave bands and subtracting a number of attenuation factors according to the following equation:

$$Lp = Lw - A_{geo} - A_{atm} - A_{gr} - A_{bar}$$

In which,

Lp :	predicted sound pressure level
Lw:	sound pressure level
A_{geo}:	geometrical divergence ($20xLog_{10}r^2+8$)
r :	Distance
A_{atm} :	atmospheric absorption
A_{gr} :	ground effect
A_{bar} :	barrier attenuation
A_{misc}:	miscellaneous other effect

Noise level data of noise source

The major construction machinery used in the construction work will include trucks and back hoes for excavation, crawler crane, truck cranes, trailer and forklift for transportation of the equipment and material, mixers for producing concrete and other machine as air compressor and generator.

Piling work for the basis will not be conducted because the project site has an adequate foothold.

Table 13.6-1 shows the noise level of the construction machinery and the number of machines.

The noise level calculation covers constructions of turbine equipment and an heat recovery steam generator in block 1, a turbine building in block 2, a control center building, an intake pump building, and electric transformer equipment.

Table 13.6-1 Noise Level of Major Construction Machinery

Works	Machine	Capacity	Power level (dB)	Number of machines
Block 1 Installation of turbine equipment	Crawler crane	25-650 t	97	2
	Truck crane	45-300 t	109	4
	Forklift	800 t	105	1
	Trailer	30-50 t	113	6
	Truck	2-11 t	109	10
Block 1 Installation of heat recovery steam generator	Crawler crane	25-650 t	97	2
	Truck crane	45-300 t	109	4
	Forklift	800 t	105	1
	Trailer	30-50 t	113	6

Works	Machine	Capacity	Power level (dB)	Number of machines
	Truck	2-11 t	109	10
Block 2 Construction of turbine building	Crawler crane	25-650 t	97	2
	Truck crane	45-300 t	109	4
	backhoe	1.0-4.0 m^3	102	10
	concrete pumping truck	100 m^3/h	110	3
	truck-mixer	4 m^3	101	9
Construction of control center building	Crawler crane	25-650 t	97	1
	Truck crane	45-300 t	109	2
	backhoe	1.0-4.0 m^3	102	5
	concrete pumping truck	100 m^3/h	110	2
	truck-mixer	4 m^3	101	5
	Air compressor	10.6 m^3/min	106	1
	Generator	60-600 kVA	101	5
Construction of intake pump building etc.	backhoe	1.0-4.0 m^3	102	3
	concrete pumping truck	100 m^3/h	110	1
	truck-mixer	4 m^3	101	3
Installation of electric transformer equipment	Crawler crane	25-650 t	97	2
	Truck crane	45-300 t	109	7

Note: EIA statements of recent gas turbine power plant in Japan
(Source: Study Team)

Calculation conditions

The calculation was conducted in respect to the construction of the power generation plant. All the aforementioned machines were assumed to be operating simultaneously.
Construction activities will be actually conducted, leveling out the construction amount and scale, based on the construction schedule; therefore, all the machinery will not be operated simultaneously.

The totals of 16 points used for simulation were selected at the boundary of power plant site and another 5 points at the nearly residences and commercial facilities were also selected for simulation.

This calculation takes account of the barrier effect as the vicinity of the west side of the site boundary is about 10m above the surrounding terrain.

(Source: JICA Study Team)

Figure 13.6-1 Location of Simulation Points

Results of simulation

Table 13.6-2 shows the result of simulating the noise level during the construction of the plant equipment. Figure 13.6-3 shows the distribution of noise levels.

Noise level generated by construction activities is 37 to 57 dB(A) at the boundary of the power plant site and 44 to 51 dB(A) at the residence.

The noise levels at 2 points in resides exceed the night-time noise level standard of Azerbaijan and IFC/WB guideline.

Construction work is not implemented at night in principle. The noise levels at all points in residence not exceed the day-time noise level standard of Azerbaijan and IFC/WB guideline.

Noise impact caused by construction activities will be mitigated by managing the construction schedule in order to level out the construction amount and scale as well as introducing up-to-date low-noise equipment's.
Temporal noise insulation fences will be installed around the site as necessary.

Large equipment transportation will be mainly conducted by shipping, and schedule management will maintain level amounts of the vehicles.
Measures for reducing generation of noise, such as speed reduction of vehicles in residential areas, will be taken, whereby vehicle noise impact will be minimized. Thus, all efforts will be made to minimize the noise impact.
Monitoring on noise levels will also be necessary.

Table 13.6-2 Results of Simulating Noise Levels from Construction Work

Place	Simulation Points	Noise Levels (dBA)	Azerbaijan Standard	IFC/WB EHS Guidelines: General
Project Boundary	No. 1	37	Day 65 Night 55	Day 70 Night 70
	No. 2	40		
	No. 3	42		
	No. 4	46		
	No. 5	49		
	No. 6	51		
	No. 7	51		
	No. 8	47		
	No. 9	45		
	No.10	50		
	No.11	47		
	No.12	44		
	No.13	57		
	No.14	57		
	No.15	48		
	No.16	48		
Commercial Facility	No.17	50	-	Day 70 Night 70
Settlement	No.18	48	Day 55 Night 45	Day 55 Night 45
Commercial Facility	No.19	52	-	Day 70 Night 70
Settlement	No.20	51	Day 55 Night 45	Day 55 Night 45

Place	Simulation Points	Noise Levels (dBA)	Azerbaijan Standard	IFC/WB EHS Guidelines: General
Settlement	No.21	44		Day 55 Night 45

Reference: Recommendations on Environment Protection in Road and Bridge Design, Moscow, 1995 and IFC/WB EHS Guidelines General, 2007

(Source: JICA Study Team)

(Source: JICA Study Team)

Figure 13.6-2 Results of Simulating Noise Level from Construction Work

<Vibration>

Operation of heavy equipment and trucks will cause impact from the temporary vibration. In particular, pile driving will cause impact from the strong vibration into surrounding broader areas. There is some residences located near the project site, and sufficient consideration must be given to minimizing any vibration impact.

The level of vibration resulting from the operation of the construction machinery was simulated using the following estimation model.

Vibration level estimation model

Following model normally used in Japan calculates the predicted vibration level by taking the source power level for equipment in separate octave bands and subtracting a number of attenuation factors according to the following equation:

$$Lp = Lo - 10 Log10(r/r_o) - 8.68\,\alpha\,(r - r_o)$$

In which,

Lp :	predicted level
Lo:	Vibration level at the benchmark of r_0(m) from the vibrating points (dB)
r :	Distance from vibrating sources to the prediction points (m)
ro :	Distance
α	Invariable of internal damping (0.01) 0.01 is set as the invariable for calculation to make internal damping lowest. This decision takes account of the boring survey results finding soil texture either sandiness or clay.

Vibration level data of vibration source

The major construction machinery used in the construction work will include trucks and back hoes for excavation, crawler crane, truck cranes, trailer and forklift for transportation of the equipment and material, mixers for producing concrete and other machine as air compressor and generator.

Piling work for the basis will not be conducted because the project site has an adequate foothold.

Table 13.6-3 shows the level of the construction machinery and the number of machines.

The vibration level calculation covers constructions of turbine equipment and a heat recovery steam generator in block 1, a turbine building in block 2, a control center building, an intake pump building, and electric transformer equipment.

Table 13.6-3 Vibration Level of Major Construction Machinery

Works	Machine	Capacity	Vibration level at 7m from source (dB)	Number of machines
Block 1 Installation of turbine equipment	Crawler crane	25-650 t	52	2
	Truck crane	45-300 t	52	4
	Forklift	800 t	55	1
	Trailer	30-50 t	64	6
	Truck	2-11 t	64	10
Block 1 Installation of heat recovery steam generator	Crawler crane	25-650 t	52	2
	Truck crane	45-300 t	52	4
	Forklift	800 t	55	1
	Trailer	30-50 t	64	6
	Truck	2-11 t	64	10
Block 2 Construction of turbine building	Crawler crane	25-650 t	52	2
	Truck crane	45-300 t	52	4
	backhoe	1.0-4.0 m^3	55	10
	concrete pumping truck	100 m^3/h	45	3
	truck-mixer	4 m^3	45	9
Construction of control center building	Crawler crane	25-650 t	52	1
	Truck crane	45-300 t	52	2
	backhoe	1.0-4.0 m^3	55	5
	concrete pumping truck	100 m^3/h	45	2
	truck-mixer	4 m^3	45	5
	Air compressor	10.6 m^3/min	55	1
	Generator	60-600 kVA	51	5
Construction of intake pump building etc.	backhoe	1.0-4.0 m^3	55	3
	concrete pumping	100 m^3/h	45	1

Works	Machine	Capacity	Vibration level at 7m from source (dB)	Number of machines
	truck			
	truck-mixer	4 m^3	45	3
Installation of electric transformer equipment	Crawler crane	25-650 t	52	2
	Truck crane	45-300 t	52	7

Note: EIA statements of recent gas turbine power plant in Japan
(Source: Study Team)

Calculation conditions

The totals of 16 points used for simulation were selected at the boundary of power plant site and another 5 points the nearly residences and commercial facilities were also selected for simulation. The calculation was conducted at the same point as Vibration simulation.

Results of simulation

Table 13.6-4 shows the result of simulating the vibration level during the construction of the plant equipment.
Vibration level generated by construction activities is 19 to 48 dB at the boundary of the power plant site and 25 to 40 dB at the residence.

The vibration levels at all points is low level and satisfy with standard of Japan.
Furthermore, all the predicted values are enough below the threshold level, around 50dB, at which human being can feel vibration.
Vibration impact caused by construction activities will be mitigated by managing the construction schedule in order to level out the construction amount and scale as well as introducing up-to-date low-vibration equipment's.

Large equipment transportation will be mainly conducted by shipping, and schedule management will maintain level amounts of the vehicles.
Measures for reducing generation of vibration, such as speed reduction of vehicles in residential areas, will be taken, whereby vehicle vibration impact will be minimized. Thus, all efforts will be made to minimize the vibration impact.

Table 13.6-4 Results of Simulating Vibration Levels from Construction Work

Place	Simulation Points	Vibration Levels (dB)	Japanese Standard
Project Boundary	No. 1	19	Day 60 Night 55
	No. 2	23	
	No. 3	27	
	No. 4	32	
	No. 5	38	
	No. 6	46	
	No. 7	41	
	No. 8	48	
	No. 9	48	
	No.10	40	
	No.11	34	
	No.12	28	
	No.13	29	
	No.14	29	
	No.15	18	
	No.16	19	
Commercial Facility	No.17	40	Day 60 Night 50
Settlement	No.18	36	Day 55 Night 45
Commercial Facility	No.19	40	Day 60 Night 50
Settlement	No.20	26	Day 55 Night 45
Settlement	No.21	25	

(Source: JICA Study Team)

6) Odor

In case domestic waste from the workers' camp is not appropriately treated, the rotting waste may produce a foul odor. Before starting the construction work, workers will be instructed to classify and collect garbage and illegal waste disposal will be prohibited. Garbage will be disposed on a periodic basis to ensure that odor by putrefaction is not produced. These measures will be taken to minimize the generation of odor.

7) Substratum contamination

Muddy water will be generated during dredging work and land formation excavation. Domestic waste water and oil-containing waste water will be generated.

Temporary rainwater drainage, sedimentation pond will be installed around the construction area. Its surface water shall be discharged to the Caspian sea after the sedimentation treatment.
In case dredging is conducted on installing intake equipment, the use of the silt fence or sheet and of pump dredgers with less turbidity generation will be considered in order to minimize turbidity.

A wastewater treatment facility for workers, such as a septic tank and temporary toilet, an oil separator for oily run-off water, will be installed in the worker's camp and construction area.

(2) Natural environment

1) Terrestrial ecosystems and rare species

The site has a small sandy beach. Herbs and shrubs are scarce. Loss of habitat of animals and vegetation is expected. However similar environment extends into surrounding broad sandy beach areas. Limited impact on the ecosystems is expected.
Construction work will generate air pollution, noise and vibration, etc. that will have impact on the terrestrial ecosystems. However, the range of such impact will be very limited
No precious species of flora/fauna inhabit the project site.
Mitigation measures for air pollution, noise and vibration will be implemented.
Bird hunting by workers shall be prohibited. The plant site is vegetated with plants living in the surrounding coast or plant species resistant to salt damage.

2) Marine ecosystems and rare species

The dredging work for cooling water facilities and land reclamation are likely to generate muddy water.
Dredging method generating less turbidity will be adopted. Waste water from the construction activity will be treated by the treatment system before discharge.
If sea grass will widely disappear by construction activities, creation of see grass bed will be conducted for fishes and benthos with cooperation of MENR.

(3) Social environment

1) Local economy including employment and means of livelihood

Since the site is governmental land and not been used for farmland and residential area, the construction and operation will have no impact.
Local people may be employed as workers by the power plant. It may purchase materials and equipment items in the local area.
Especially in the construction phase, project proponent will employ local residents as many as possible and use of the services (i.e. laundry and catering service etc.) and products offered in the local community, as possible.

Job training will be provided as necessary for new employees.

2) Water use

There are few large ships at the sea with shoals in front of the plant, where water depth gets 7m around 1.3km off the coast.

The fishing in front of the project site is prohibited. In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore.

Muddy water may be generated from dredging work and land reclamation and excavation work, resulting in impact on the recreational fishing.

Dredging method generating less turbidity will be adopted. Waste water from the construction activity will be treated by the treatment system before discharge.

Public awareness will be conducted as dredging plans and construction schedule among the local people.

3) Existing social infrastructure and social service

Inflows of workers may need to build lodging houses, medical treatment facilities, sewer systems and other infrastructure.

Especially in the construction phase, project proponents will employ- as possible.

Workers coming from other than the local area shall be accommodated in the rented housing in the surrounding area to minimize the area of the worker’s camp.

Traffic during construction is expected to increase.

Project proponent will conduct the traffic control plan including route-setting and training safe operation of vehicles.

4) Unfair distribution of damage and benefit

If employing local people and/or outsourcing contracts are not fair, benefit may be unfairly distributed.

The employment of the local people shall be conducted under publicized employment conditions to prevent unfair employment.

6) HIV/AIDS and other infectious diseases

A temporary influx of migrant labor during the construction period may increase the risk of sexual transmitted diseases, etc. Local people should be recruited for simple work as much as possible so to minimize the risk of infectious diseases being transmitted from external workers. Pre-employment and periodic medical check-ups should be conducted for external workers (technical workers, etc.).

7).Work environment (including labor safety)

Workers may have accidents during service.

Project proponent will develop the safety and sanitation management plan and implement the regular medical checkup.

Project proponent will subcontract a security firm to deploy security guards.

(4) Other

1) Accident

Traffic accidents may occur during operation of vehicles.

Large machines shall be transported through the sea to the possible extent.

Land transportation shall use the existing highways and other existing roads shall be used as much as possible.

Land traffic and marine traffic accidents during construction work may occur. As prevention measures for land traffic accidents, observation of traffic regulations, and training and education on safe driving will be implemented. People in the surrounding villages shall be informed of the bus schedules. For vessel operation, marking buoys will be set around the construction area for marine safety. Vessel schedules shall be announced to fishermen, etc.

2) Impact across the borders and on climatic change

CO_2 is generated during construction, but the impact is limited to a temporal period. Periodic inspections and maintenance of heavy machine and vehicles are same situation.

13.6.2 Operation Phase

(1) Pollution

1) Air quality

Emission gas

Nitrogen oxides (NOx) will be generated by the operation of gas turbine of the power plant. Low-NOx Burner will be adopted in this turbine, and exhaust concentrations will be kept below emission standards a of the IFC/WB EHS guidelines.

Table 13.6-5 Emission Concentration and Emission Standard

Item	Unit	Proposed Concentration	IFC/WB EHS guidelines (Thermal power plants; 2008)
NOx	mg/Nm^3	＜51	51

Note: O_2＝15% equivalent
Source: Study Team

The prediction on impact regarding dispersion of air pollutant is approached by mathematical models. The model regarding dispersion of air pollutant is shown in the following formula, Gaussian models.

$$C(x,y,z) = \frac{Q_P}{2\pi\ \sigma_y \sigma_z U} \cdot \exp\left(-\frac{y^2}{2\sigma_z{}^2}\right)\left[\exp\left\{-\frac{(z-He)^2}{2\sigma_z{}^2}\right\} + \exp\left\{-\frac{(z+He)^2}{2\sigma_z{}^2}\right\}\right] \times 10^6$$

C : Ground concentration at a point R (m) below the downwind axis
Q p : Emission volume (g/s)
σ y : Parameter in the horizontal direction (m)
σ z : Parameter in the vertical direction (m)
u : Wind speed (m/s)
R : Horizontal distance between emission source and calculated point (m)
z : Ground height
He: Effective stack height (m)
$He = H + \Delta H$
H: Stack height (m)

ΔH: Emission gas elevation height (m): following CONCAWE formula
$\Delta H = 0.175\ QH^{1/2}\ u^{-3/4}$
ΔH: Emission elevation height (m)
QH: Exhaust heat (cal/s)
u : Wind speed at the top of stack (m/s)
$QH = \rho \cdot Q \cdot Cp \cdot \Delta T$
ρ : Emission gas density at 0 ℃ (cal/s) ($1.293 \times 10^3 g/m^3$)
Q: Amount of exhaust gas per unit time (Nm^3/s)
Cp: Constant pressure specific heat (0.24cal/K/g)
ΔT : Difference between emission gas temperature and atmospheric temperature (K)

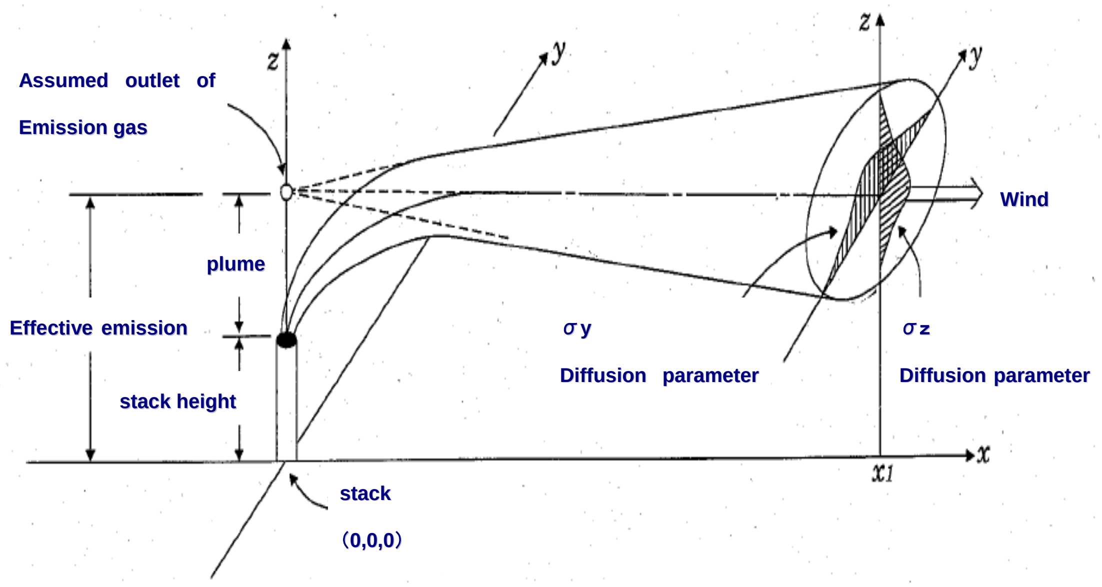


Figure13.6-3 Gaussian Diffusion Model Diagram

Reference: Lecture of Air Environment Prediction, Shinichi Okamoto, 2001

Emission specifications

Since natural gases will be used as fuels, sulfur oxides and dust (PM: particle matters) will not be generated.

Table 13.6-6 shows the exhaust volume, temperature, speed, and emissions of nitrogen oxides (NOx) emitted from the stack are assumed to become NO_2 respectively.

Table 13.6-6 Emission Specifications

Item	Unit	CCPP 1	CCPP 2
Emission volume (wet)	Nm^3/h	$2,193\times10^3$	$2,193\times10^3$
Exhaust temperature	ºC	95	95
Exhaust speed	m/s	25	25
Stack height	m	80	80
Diameter of stack	m	6	6
NOx	kg/h	135.9	135.9

Notes: The values indicate the values under the maximum continuous load.

(Source: JICA Study Team)

Meteorological Conditions

Atmospheric stabilities at the stack outlet level tend toward neutral compared to the stabilities at ground level, according to the Pasquill stability categories shown below and wind speed. In simulating a dispersion model, atmospheric stabilities at the stack outlet level was set on rather the neutral side than the stabilities at ground level; for example, stability “A” was replaced with stability “B”, stability “B” was replaced with “C” and “C” was replaced with “D”.

Table 13.6-7 Pasquill Stability Categories

Wind speed at Ground Level U (ms^{-1})	Daytime				Nighttime (Rate of Solar Radiation = 0)
	Rate of Solar Radiation Q (unit 0.01 kWm^{-2})				
	60 – Q	30 - 59	15 - 29	1 - 14	
U – 2.0	A	A-B	B	D	F
2.0 - 2.9	A-B	B	C	D	E
3.0 - 3.9	B	B-C	C	D	D
4.0 - 5.9	C	C-D	D	D	D
6.0 – U	C	D	D	D	D

Note: This category shows the stability of the atmosphere proposed by Pasquill. Category A indicates very unstable atmospheric condition; category B unstable atmospheric condition; category C less unstable; category D neutral; category E less stable; and category F stable.

(Source: http://www.env.go.jp/recycle/misc/facility_assess/mat02.pdf)

Geographic effects

The surrounding geography more than 5km away from the site in the direction of west can be higher than the site.

In “Environmental Impact Assessment Guidelines for Power Plant” (2007) published by Ministry of Economy, Trade and Industry of Japan, the impacts of geography on the exhaust gas dispersion shall be considered in case upland with a condition below is within a 5km radius from the smoke source.

・maximum altitude / Effective stack height (Actual stack height + Emission gas elevation height) ≧0.6

In this project, effective stack height is expected to be about 200 m and there is no mountainous area above 120 m within 5 km. Therefore, the geographic effects are not considered here.

Consideration of stack height

Unless stack height is relatively high, compared to the surrounding buildings, a phenomenon called downdraft may occur by entrainment to the ground at the downstream of the buildings as shown in Figure 13.6-4, sometimes resulting in high ground concentration of pollutant.

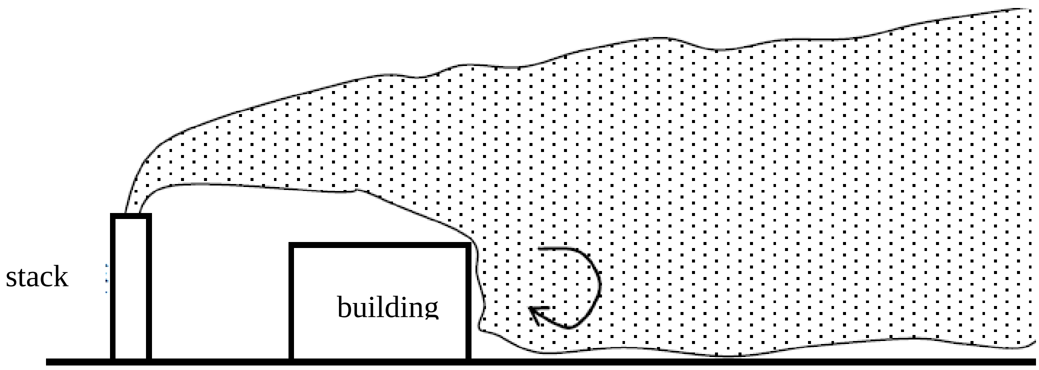


Figure 13.6-4 Diagram of Downdraft

In case that value of HG calculated by the formula shown below is higher than the stack height, the effect of downdraft needs to be considered.

HG = H + 1.5L

H = Height of nearby structure(s) above the base of the stack (m)

L = Lesser dimension, height (h) or width (w), of nearby structures at wind flow side

"Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.

With regards to this project, the highest HG value is 75 m (Turbine Building); whereas, stack height is set as 80 m, which is higher than the highest HG value.

Consideration according to the occurrence of downwash

When the exhaust gas velocity is lower than 1.5 times of the wind speed on stack height, there is a high concentration area of air pollutants in the ground occurs on the downwash by entrainment to the ground near stack, as shown in Figure13.6-5.

The exhaust gas velocity at this project is 25 m/s, and downwash may occur in case wind speed at stack height (80 m) is 17 m/s or more.

Approximately 17 m/s of wind speed at the top of stack is estimated approximately 8 m/s of wind speed at the height of 3 m above ground level. According to the result of meteorology survey, frequency of occurrence for approximately 8 m/s of wind speed is about 30 %, and downwash is taken into consideration at the prediction.

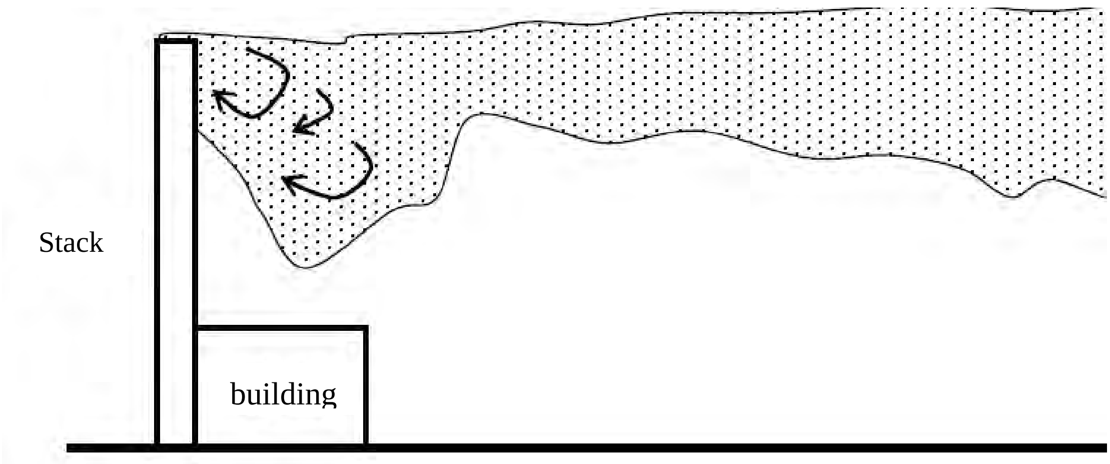


Figure 13.6-5 Diagram of Downwash

Meteorological data from Sumgayit meteorological station about 20 km southeast of the project site was used for exhaust gas dispersion model on annual average and 24–hour values.
Meteorological data for 3 years (2011-2013) was, which had 365 days of wind speed and wind direction data, was used in the simulation.
As for a 1-hour value, a dispersion model was simulated on the conditions of the stabilities and wind speed.
Table 13.6-8 and Figures 13.6-6 to Figure 13.6-8 show the prediction concentrations in ambient air quality, considering background concentration and the contributed concentration (annual average value, daily average value and 1-hour value) for this project based on the simulation. The outlines of the contributed concentration based on the simulation are described below.

- **Annual average value**

The contributed concentration from the power plant is0.6-0.7 μg/m^3 at a maximum, which is far below the measurement full limits of air quality (1μg/m^3).
The contributed concentrations are less than 1/60 of IFC/WB guideline values and environmental standard values of the EU which is 40 μg/m^3.
The contributed concentration to Sumgayit, which is located 20km away in the southwest from the plant, is extremely low at 0.1-0.3 μg/m^3.

- **24 hour value**

The contributed concentration from the power plant is 4.4- 7.7 μg/m^3 at a maximum for 2011-2013. The contributed concentrations are less than 1/10 of Japanese ambient air quality standard values which is 75 to 110 μg/m^3.
Predicted concentration, taking into account the background concentration, is 64.4 to 90.7 μg/m^3 and satisfies the ambient air quality standard of Japan.
The contributed concentration to Sumgayit is also extremely low at < 1μg/m^3.

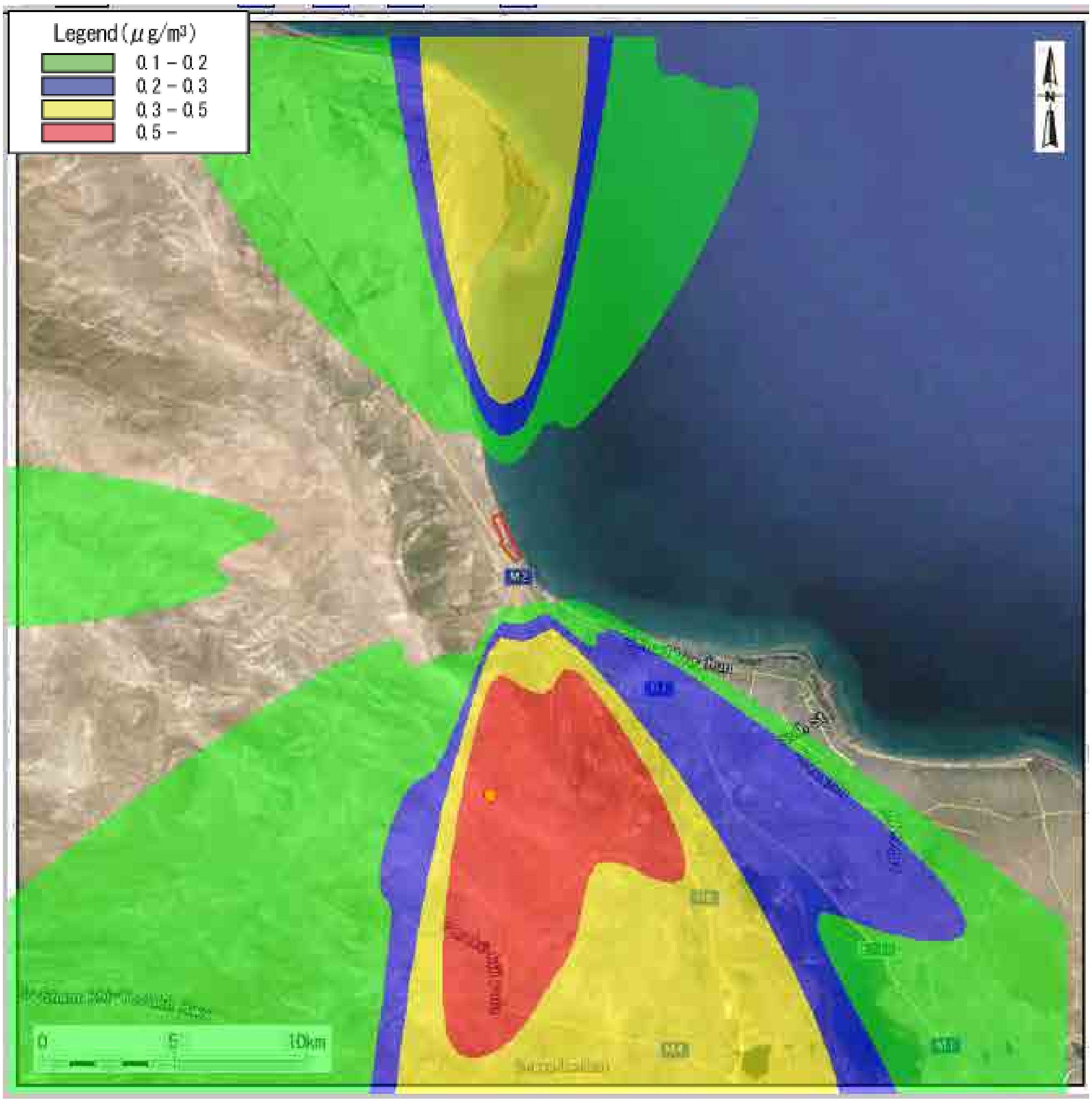
- **1 hour value**

In the case of atmospheric stability B, C and D, Contributed concentration from the power plant is 19.0 μg/m^3 at a maximum. The contributed concentrations are less than 1/10 of the IFC/WB guideline value and EU ambient air quality standard value which is 200 μg/m^3.
Predicted concentration, taking into account the background concentration, is 75.9 to 119.0 μg/m^3 and satisfies the IFC/WB guideline value and EU ambient air quality standard value.
The contributed concentration to Sumgayit is also extremely low at 1-5 μg/m^3.

Table 13.6-8 Dispersion Concentration of NO_2

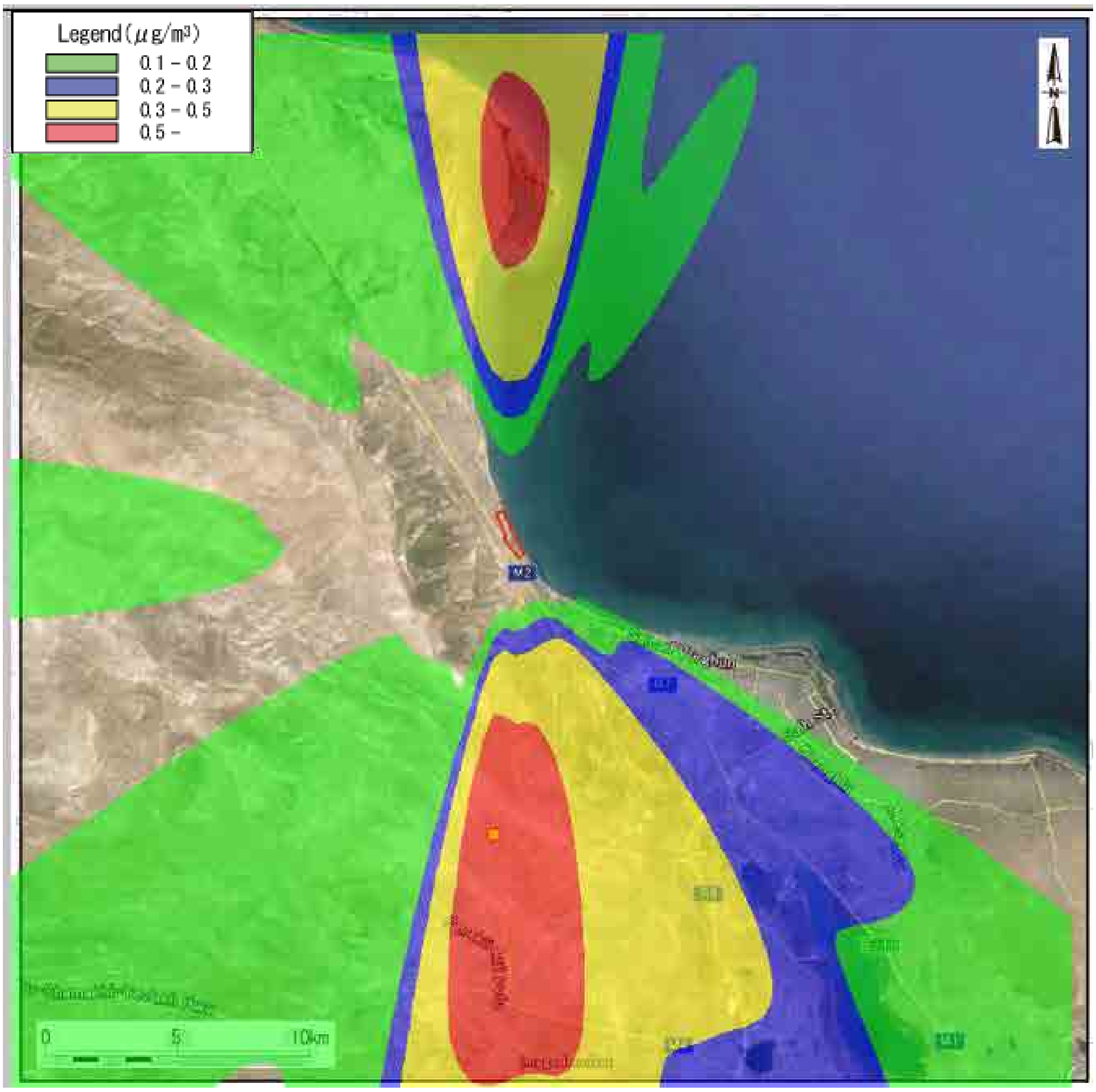
<table>
<tr><th>Time scale</th><th>year</th><th>Background concentration (μg/m³) (1)</th><th>The highest concentration (μg/m³) (2)</th><th>The appearance distance from stack (km)</th><th>Prediction concentration in ambient air quality (μg/m³) (1)+(2)</th><th>IFC guideline value (General 2007) (μg/m³)</th><th>EU Standards （Japanese Standards） (μg/m³)</th></tr>
<tr><td rowspan="3">Yearly Average</td><td>2011</td><td rowspan="3">-</td><td>0.7</td><td>8.6</td><td>-</td><td rowspan="3">40</td><td rowspan="3">40</td></tr>
<tr><td>2012</td><td>0.6</td><td>9.7</td><td>-</td></tr>
<tr><td>2013</td><td>0.6</td><td>10.0</td><td>-</td></tr>
<tr><td rowspan="3">24hr Average (Max)</td><td>2011</td><td rowspan="3">60-83</td><td>7.7</td><td>4.3</td><td>67.7-90.7</td><td rowspan="3">-</td><td rowspan="3">(75-110)</td></tr>
<tr><td>2012</td><td>4.5</td><td>6.6</td><td>64.5-87.5</td></tr>
<tr><td>2013</td><td>4.4</td><td>5.4</td><td>64.4-87.4</td></tr>
<tr><td rowspan="4">1hr Average (Max)</td><td>B,3.9m(Max)</td><td rowspan="4">70-100</td><td>19.0</td><td>2.1</td><td>89.0-119.0</td><td rowspan="4">200</td><td rowspan="4">200</td></tr>
<tr><td>C,5.9m/s(Max)</td><td>14.4</td><td>3.0</td><td>84.4-114.4</td></tr>
<tr><td>D,15m/s(Max)</td><td>5.9</td><td>6.8</td><td>75.9-105.9</td></tr>
<tr><td>Down wash D, 30m/s(Max)</td><td>13.1</td><td>2.5</td><td>83.1-113.1</td></tr>
</table>

Note: This survey result indicates only short-term result in rainy and dry season and is not suitable to be directly compared with the standard value of the annual average value.



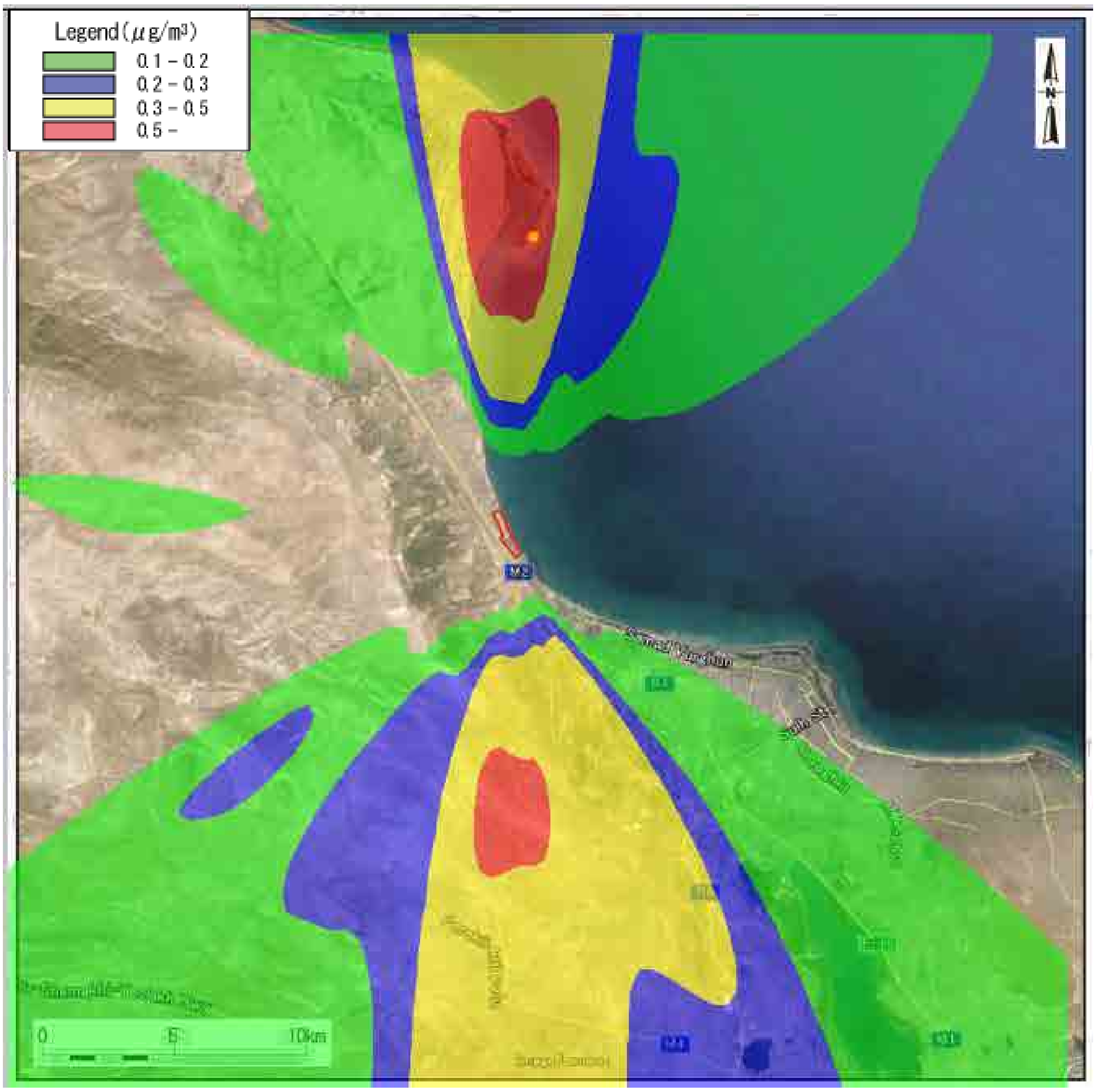
(Source: Study Team)

Figure 13.6-6 (1) Dispersion Concentration of NO_2 (Annual Average, 2011)



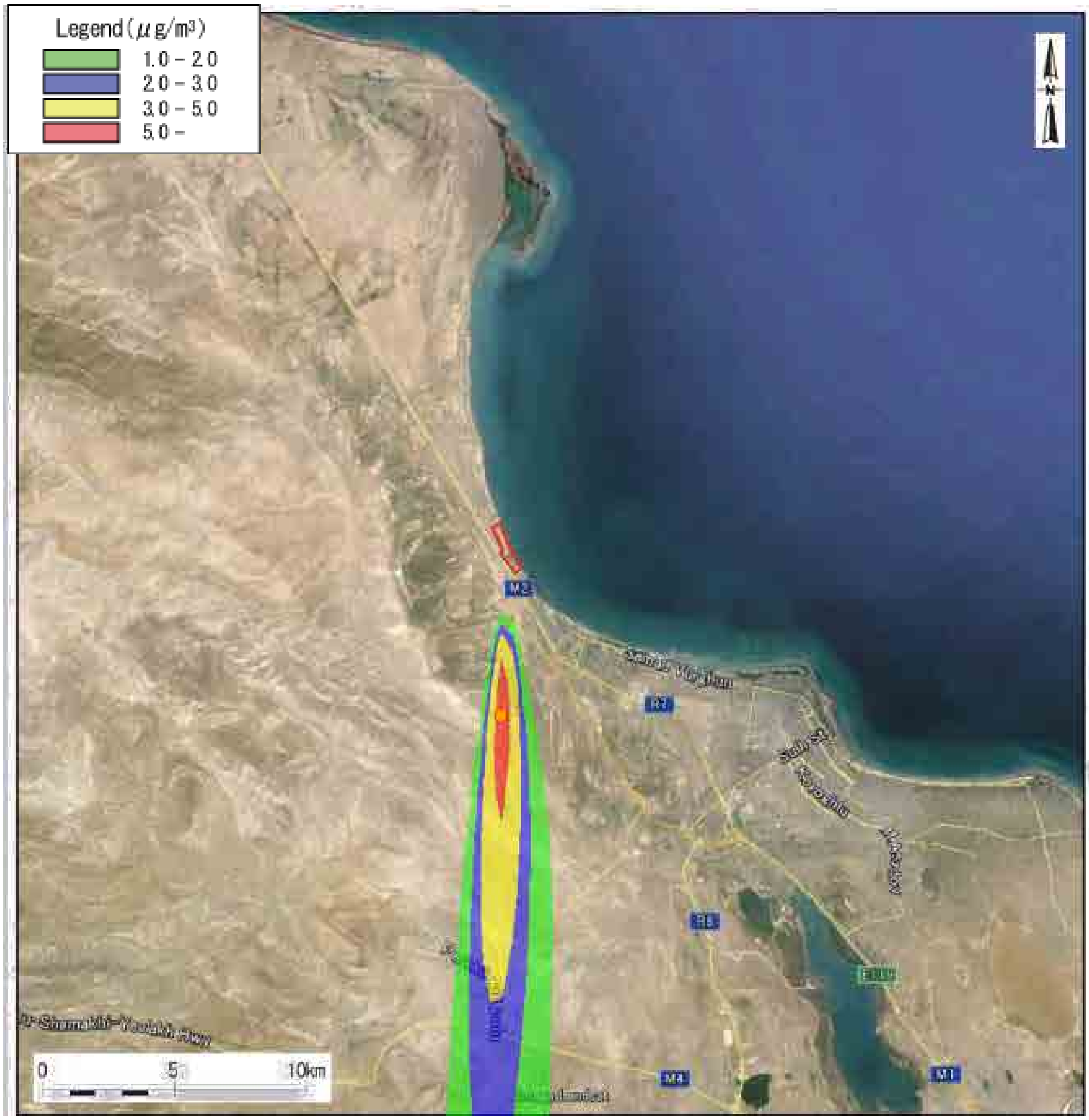
(Source: Study Team)

Figure 13.6-6 (2) Dispersion Concentration of NO_2 (Annual Average, 2012)



(Source: Study Team)

Figure 13.6-6 (3) Dispersion Concentration of NO_2 (Annual Average, 2013)

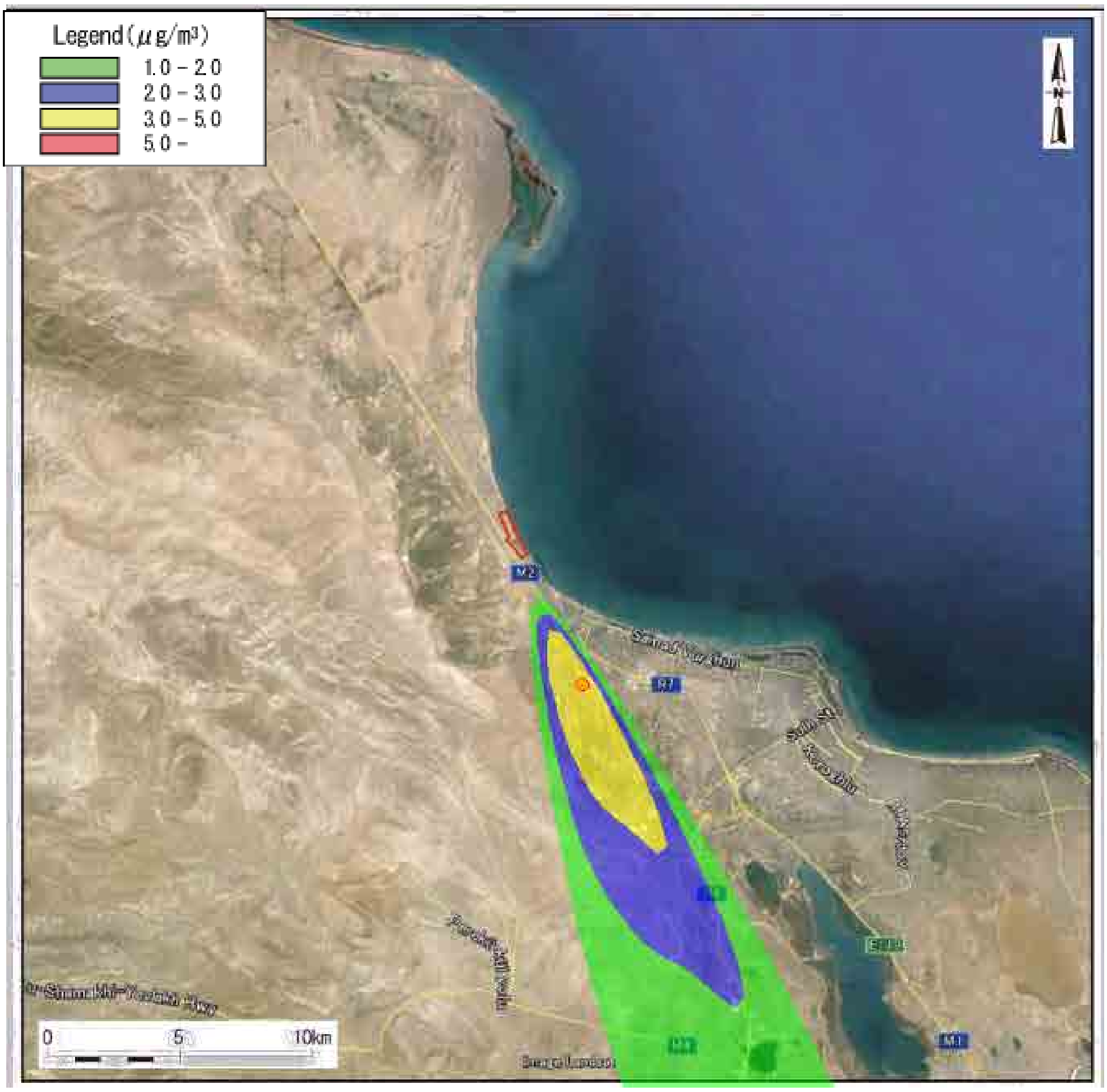


(Source: Study Team)

Figure 13.6-7 (1) Dispersion Concentration of NO_2 (24 hr Maximum, 2011)

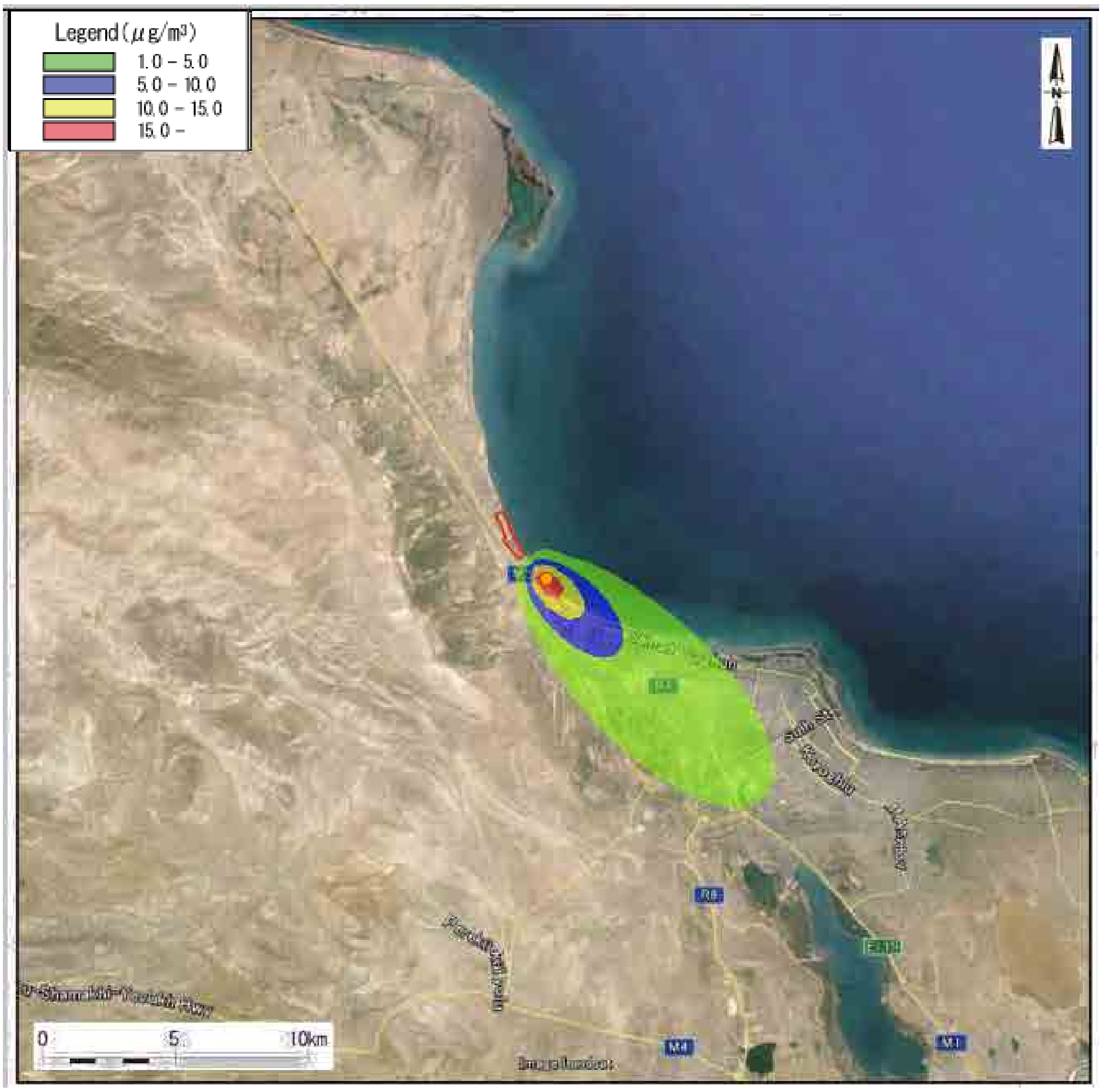
(Source: Study Team)

Figure 13.6-7 (2) Dispersion Concentration of NO_2 (24 hr Maximum, 2012)



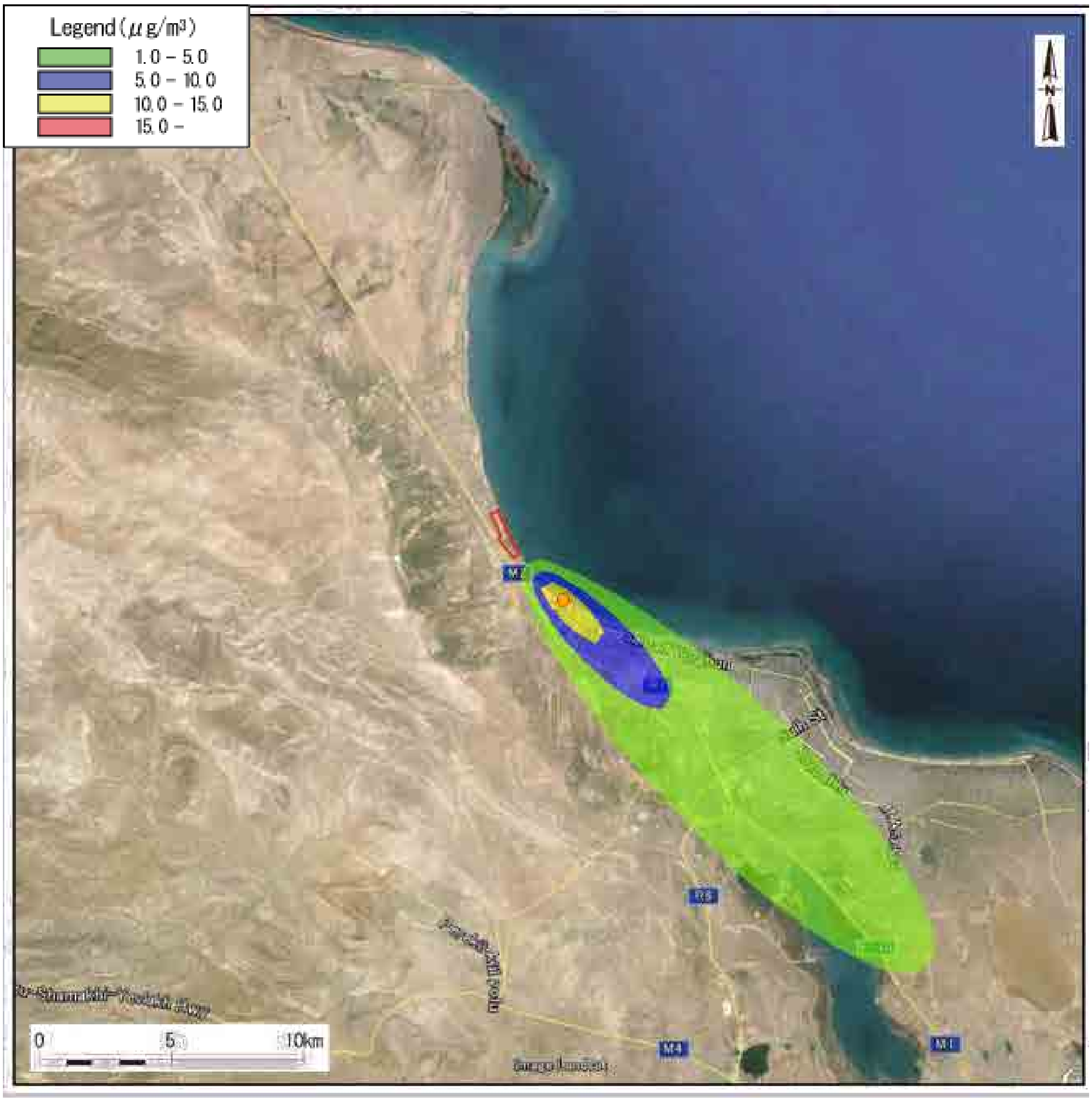
(Source: Study Team)

Figure 13.6-7 (3) Dispersion Concentration of NO_2 (24 hr Maximum, 2013)



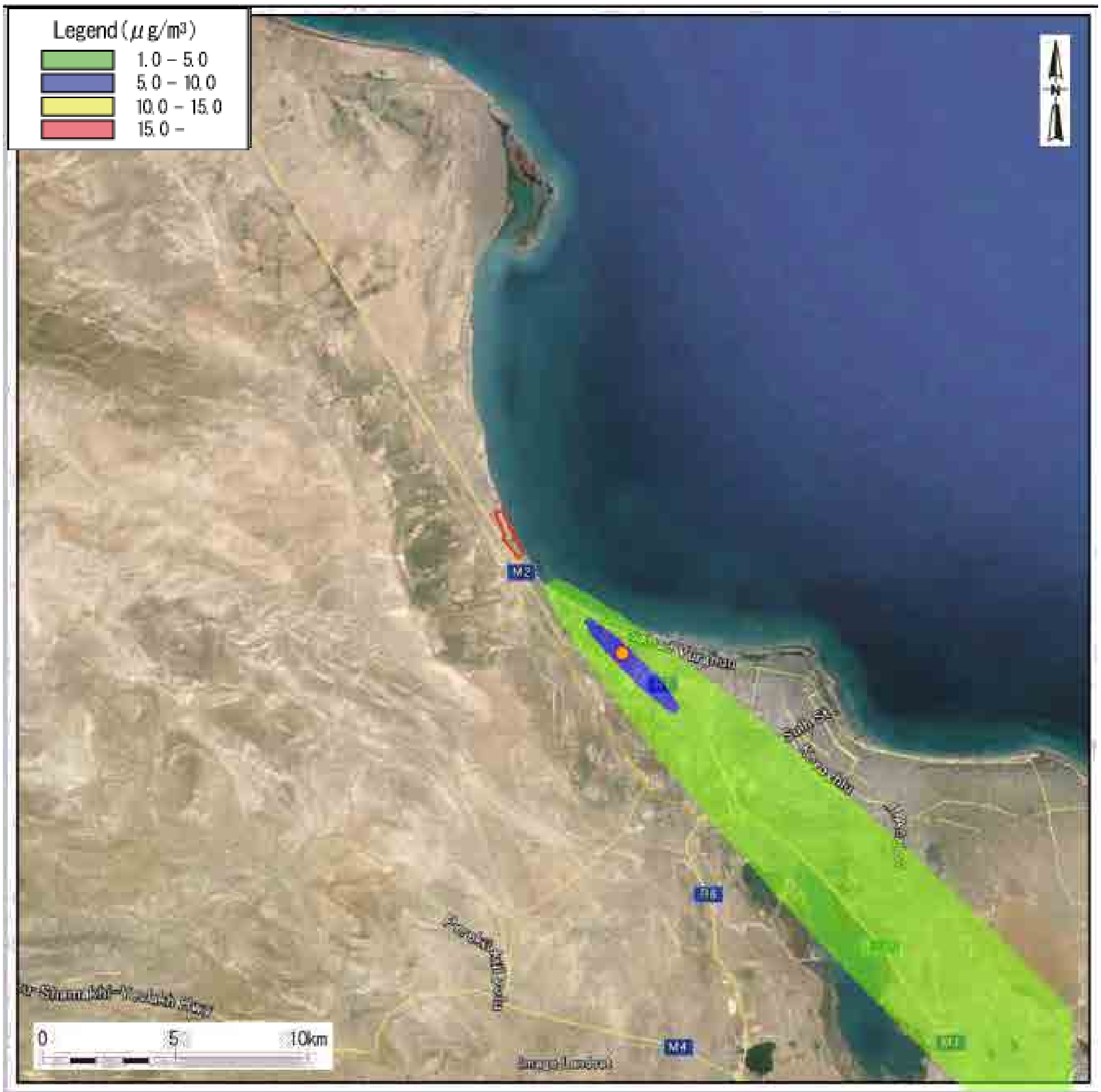
(Source: Study Team)

Figure 13.6-8 (1) Dispersion Concentration of NO_2 (B (Max) ,3.9m/s:1 hr Maximum)



(Source: Study Team)

Figure 13.6-8 (2) Dispersion Concentration of NO_2 (C (Max) , 5.9m/s:1 hr Maximum)



(Source: Study Team)

Figure 13.6-8 (3) Dispersion Concentration of NO_2 (D (Max) , 15m/s:1 hr Maximum)

(Source: Study Team)

Figure 13.6-8 (4) Dispersion Concentration of NO_2 (D (Max) , 30m/s:1 hr Maximum)

2) Water quality

In the operation of Power plant, thermal water from condenser, wastewater from raw water treatment plant (desalination plant) and regeneration waste water from demineralization plant, blow water from HRSG ,oily drainage wastewater surrounding tank of lubricant and domestic sewage from office and accommodation for staff.

Main pollutants from waste water are following;

・thermal water from condense：temperature rise, residual chlorine
・waste water from raw water treatment plant：high salinity
・regeneration waste water from demineralization plant：SS, acid, alkali
・blow water from HRSG：SS, acid, alkali
・oily drainage wastewater surrounding tank of lubricant：oil
・domestic sewage：SS, organic matter

<Thermal water>

Water intake/discharge method shall be selected to prevent the recirculation of intake/discharge, promote the mix with the surrounding sea water, and minimize the area of water temperature rise.

Cooling water shall be taken from a lower water layer 6m deep, where water temperature is low at the low rate of the approximately 0.2m/s, with an intake tower installed at the point about 1.3km (7m depth) offshore from the center of the site. Observed current flows are mostly from 0.3 to 0.6m/s around the site and higher than intake flow speed, so intake of cooling water have a little impact to marine flow.

Then, it shall be discharged at the high rate of 2.5m/s from the coast near the southern part of the project site.

Installation points and structures of intake and discharge facilities of cooling water will be shown in following Figures 13.6-9~11.

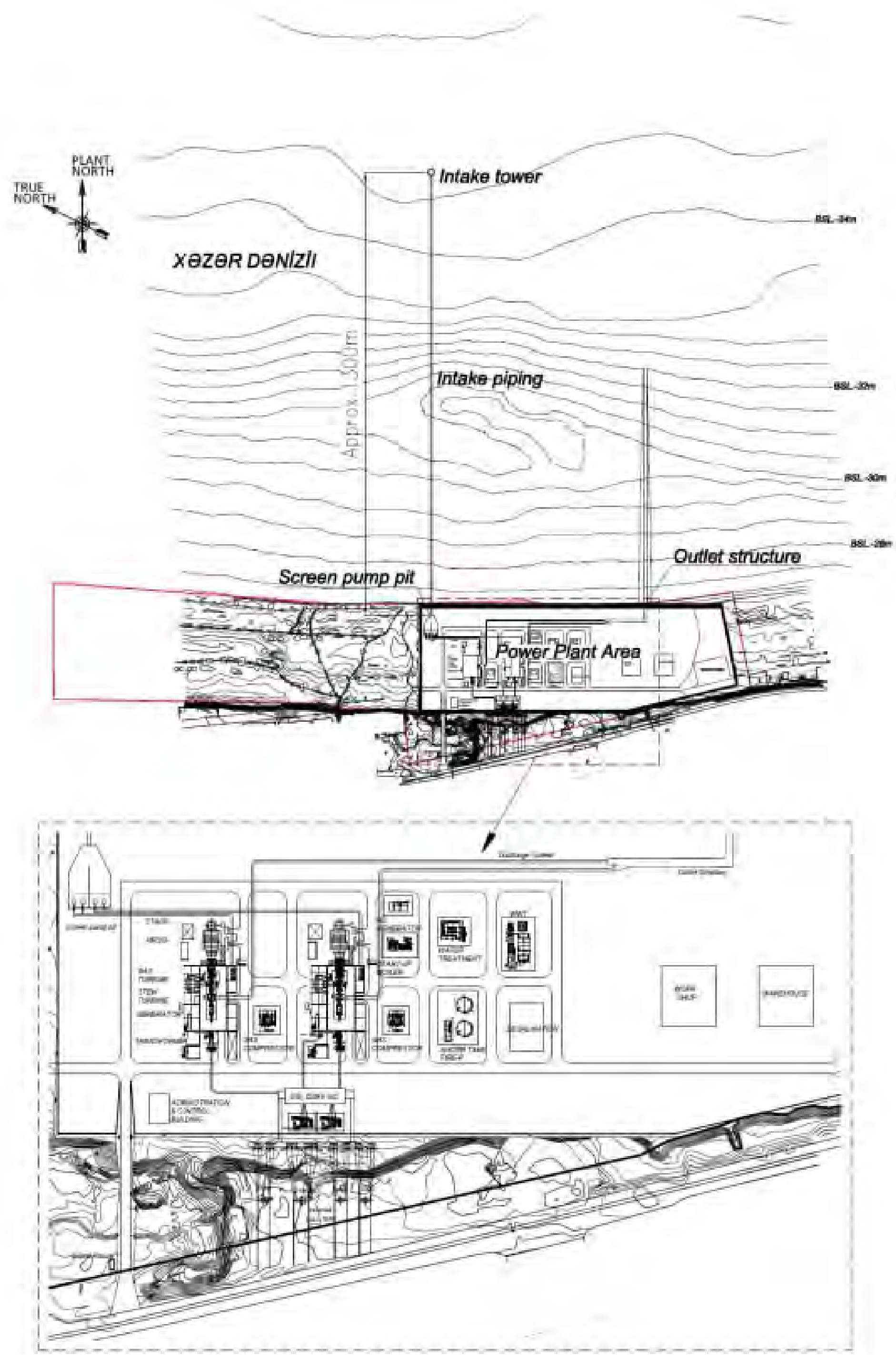


Figure 13.6-9 Intake Tower and Outlet of Cooling Water

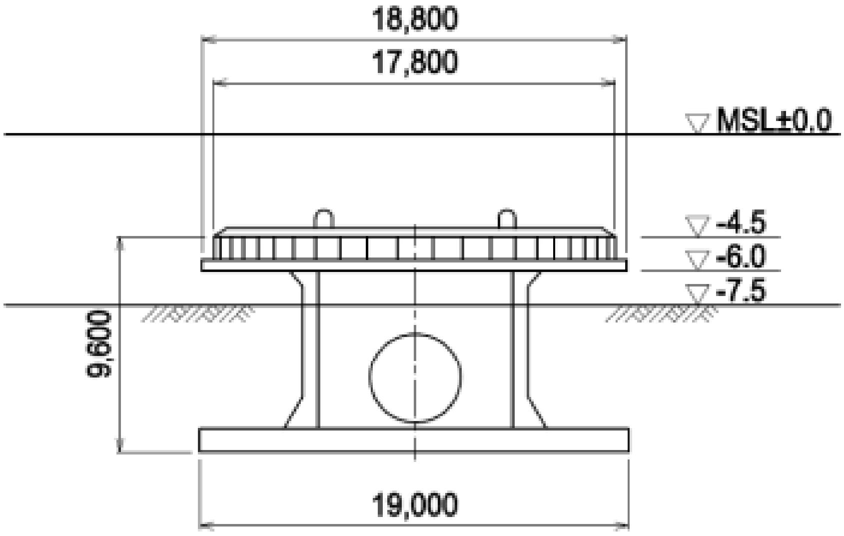


Figure 13.6-10 Water Intake Structures

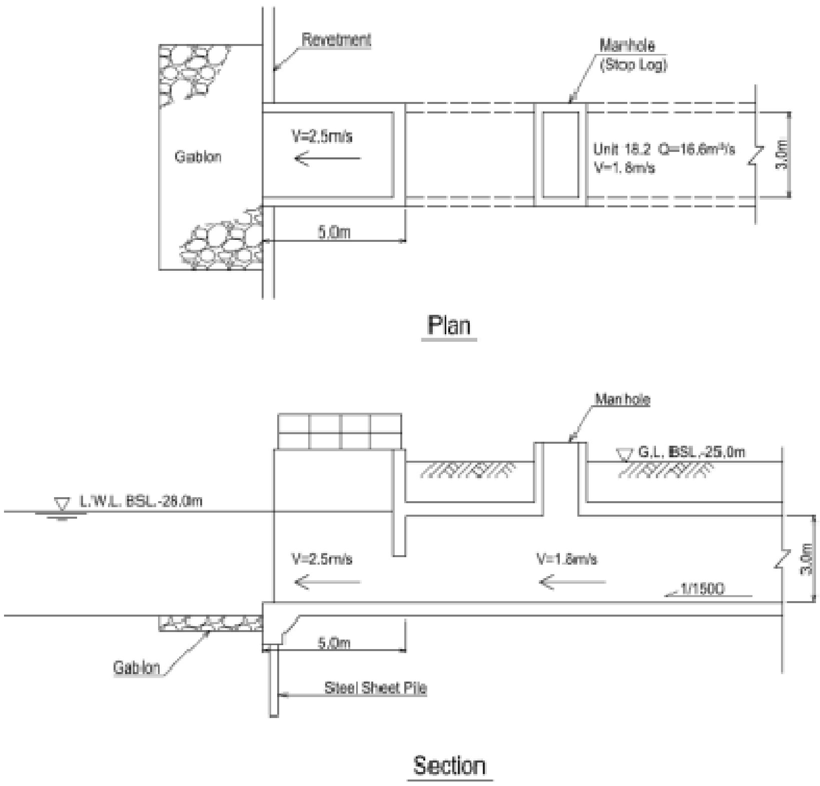


Figure 13.6-11 Water Intake Structures

A diffusion estimation model of thermal effluents from the power plant is calculated based on the following formula.

(Momentum equation)

$$\frac{\partial u}{\partial t}+\frac{\partial u^2}{\partial x}+\frac{\partial uv}{\partial y}+\frac{\partial uw}{\partial z}=-\frac{1}{\rho}\frac{\partial p}{\partial x}+\mu\nabla^2 u+\gamma\frac{\partial^2 u}{\partial z^2}$$

$$\frac{\partial v}{\partial t}+\frac{\partial uv}{\partial x}+\frac{\partial v^2}{\partial y}+\frac{\partial vw}{\partial z}=-\frac{1}{\rho}\frac{\partial p}{\partial y}+\mu\nabla^2 v+\gamma\frac{\partial^2 v}{\partial z^2}$$

$$\frac{\partial w}{\partial t}+\frac{\partial uw}{\partial x}+\frac{\partial vw}{\partial y}+\frac{\partial w^2}{\partial z}=g-\frac{1}{\rho}\frac{\partial p}{\partial z}+\mu\nabla^2 w+\gamma\frac{\partial^2 w}{\partial z^2}$$

(Continuity equation)

u,v,w	: current velocity in x, y, z
t	: time
P	: pressure
ρ	: water density
μ and ν	: coefficient of the horizontal and vertical eddy viscosity.

(Thermal diffusion equation)

$$\frac{\partial T}{\partial t}+u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}+w\frac{\partial T}{\partial x}=\frac{\partial}{\partial x}\left(Kx\frac{\partial T}{\partial x}\right)+\frac{\partial}{\partial y}\left(Ky\frac{\partial T}{\partial x}\right)+\frac{\partial}{\partial z}\left(Kz\frac{\partial T}{\partial x}\right)$$

In which,

T	: temperature
Kx, Ky, Kz	: diffusion coefficient in x, y, z

The seabed topographic data in the said sea area were set based on the bathymetric data implemented in the said sea area. The seabed topographic data were rebuilt as mesh data so that they will contribute to flow calculations and diffusion calculations.

The geometry of the coast line, etc. was read from the separately provided map, etc. to create digital data. Figure 13.6-12 shows the created seabed topography. For the flow calculation, the data were sectionalized basically at the 100 m mesh and at the 200 m mesh near the discharge.

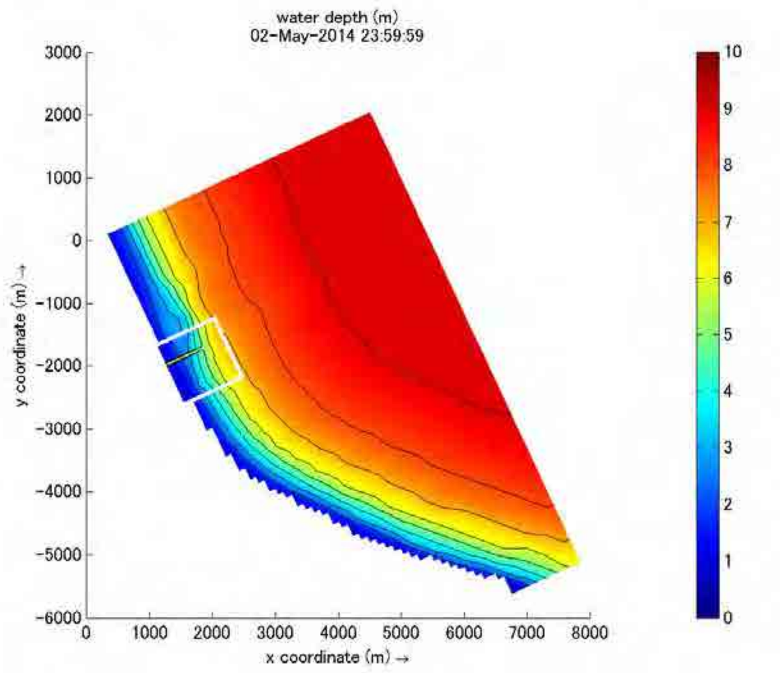


Figure 13.6-12 Sea Bed Topography

The calculation conditions are shown below;

<Discharge condition>

Item	Unit	Cooling water
Amount of discharge water	m^3/h	30,000
Velocity of discharge water	m/s	2.5
Maximum increase of outlet temperature	^oC	Δ9.0
Temperature of discharge water	^oC	40.0
Temperature of ambient seawater	^oC	14.1

*Temperature of ambient seawater is averaged at Sumgait.

< Sea water and Air condition>

Item	Unit	Sea water
Current speed and direction	m/s	0.3 (SE) 0
Ambient temperature	^oC	15.3
Wind direction	degree	N
Wind speed	m/s	7.7

＜Prediction result＞

Figure 13.6-13 shows the calculation results of dispersion of thermal effluent. In the case of the southeast current at 0.3m/s, the surface water temperature increases to 5℃, compared with 14℃ at the intake (namely 19℃), in the areas within about 180m from the water outlet in the direction of offshore and about 100m in the direction of the coast. This is below the Azerbaijan standard which allows the increase of more than 5℃ within 500 m.

In the case of the southeast current at 0 m/s, the surface water temperature increases to 5℃ in the areas within about 350m from the water outlet in the direction of offshore and about 450m in the direction of the coast. This is also below than the Azerbaijan standard.

This prediction was conducted based on the worst case scenario, which is that the water temperatures at intake point and discharge point are same.

Practically, water will be intake at 6m below surface level, and water temperature at intake point is reported 1 to 2℃ lower than the surface water temperature of discharge point, according to the water temperature data around the proposed power plant during spring and summer season.

Therefore, the range or area of temperature increase becomes smaller than the prediction result in spring and summer season.

The appropriate amount of chlorine will be added into cooling water to prevent shellfish from adhering to pipes, so that residual chlorine concentration in thermal effluent will be below the IFC/WB guidelines (0.2mg/L).

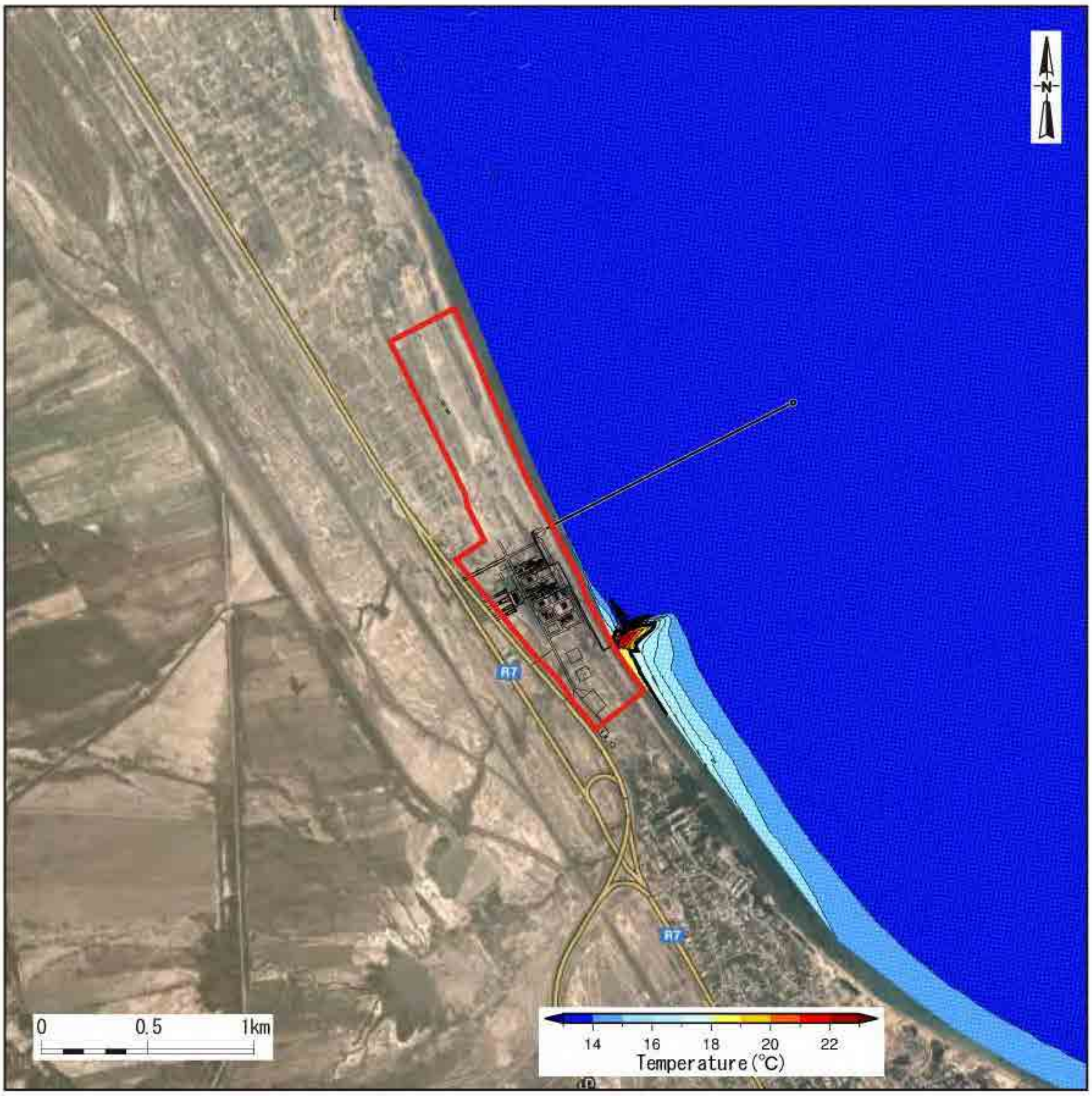


Figure 13.6-13(1) Dispersion of Thermal Effluent (Current speed 0.3m/s: SE)

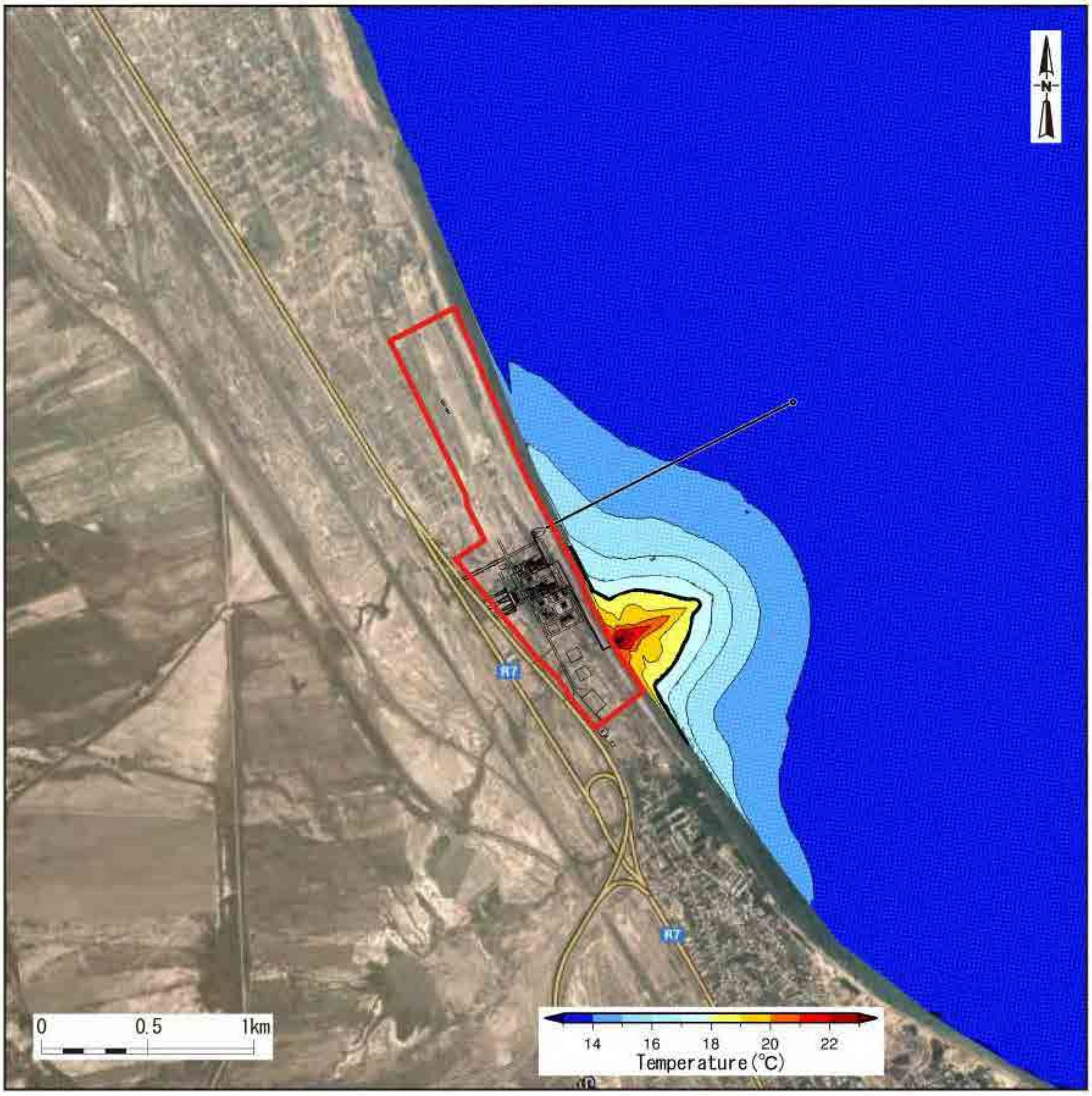


Figure 13.6-13(2) Dispersion of Thermal Effluent (Current speed 0m/s)

<Plant wastewater, oil-containing wastewater, and domestic wastewater>

Wastewater from raw water treatment plant (desalination plant) and regeneration waste water from demineralization plant, blow water from HRSG, oily drainage wastewater surrounding tank of lubricant and domestic sewage will collect in the wastewater treatment system. The wastewater treatment system will consist of neutralization, coagulating sedimentation, filtration, oil separator and aeration.

Wastewater will be managed and treated appropriately to comply with water quality of Azerbaijan regulations and IFC/EHS Guideline values for thermal power plants. Treated wastewater will be mixed and diluted with a large volume of thermal effluents and will be discharged into Caspian Sea.

The Figure 13.6-14 show the treatment method and flow diagram of waste water.

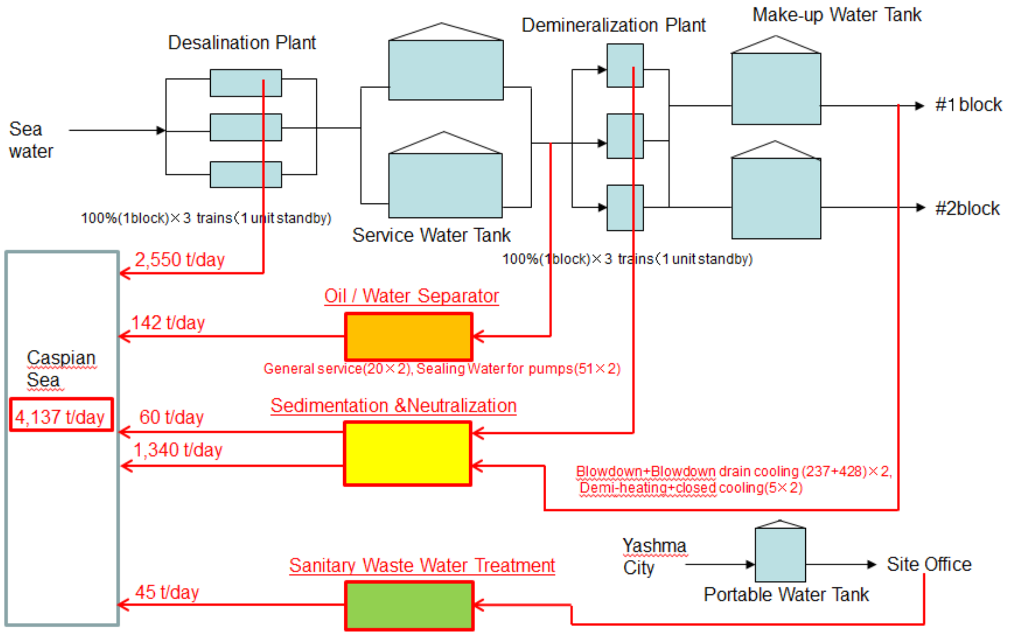


Figure 13.6-14 Waste Water Flow Diagram

The impact on water quality by the power plant operation is considered to be insignificant, because the impact intensity, duration and coverage area will be low, long term and limited, respectively.

3) Waste

General waste and hazardous waste will be generated. Workers in the power plant will produce sewerage and garbage. Waste oil will be generated from the operation and maintenance of the facilities. Sludge will be generated through precipitation treatment at the supply water treatment facility and the wastewater treatment facility.

Separating waste collection, recycling and reuse of waste will be promoted and non-recyclable waste will be disposed at appropriate sites according to the related regulations. Hazardous waste will be treated under the related regulations.
Specifically, paper wastes and iron scraps will be recycled. Other general wastes will be collected by Sumgayit city and carried to existing disposal fields.
All of the hazardous waste will be disposed by a waste management company approved by the government at disposal fields in Sumgayit which are permitted by the government in accordance with the Azerbaijan legislation.

The above measures will be taken to ensure that water pollution or sanitary problems resulting from waste do not arise.

4) Soil contamination

Lubrication oil spilled during operation of the power plant is likely to cause contamination in the soil.
Project proponent will store oil and chemical materials in a storage tank and area with dyke of concrete and method to prevent permeation into ground.

5) Noise and Vibration

<Noise>

Noise impact from the plant operation is predicted. There are residences near the project site, and sufficient consideration must be given to minimizing noise impact. The level of noise resulting from the operation of the major equipment was simulated using the following estimation model.

Noise level estimation model

An estimation of the noise level was made according to Chapter 13.6.1 Construction Phase.

Noise level data of noise source

The major equipment used in the power plant operation includes the turbine, pumps, gas compressor, transformer. The noise source level generated from the generation facility is shown in turbine building, HRSG, transformer, gas compressor, etc. for power plant facility and demineralization plant, water treatment equipment, wastewater treatment equipment etc. for utility facility.

Table 13.6-9 shows the noise level of the major equipment and the number of equipment.

Table 13.6-9 Noise Level and the Number of the Major Equipment

Item	Equipment Type	Noise Power Level (dB)	Number of Equipment
Power plant facility	Turbine building	70.0	2
	Intake air filter for gas turbine	75.0	2
	HRSG	78.0	2
	Main transformer	80.0	2
	Station service transformer	75.0	2
	Exhaust air duct for gas turbine	80.0	2
	Gas compressor	85.0	2
	330/220kVconection transformer	80.0	2
	stack	90.0	2
Utility facility	Circulation water pump building	70.0	1
	Startup transformer	75.0	1
	Desalination facility	75.0	1
	Demineralization facility	75.0	1
	Waste water treatment facility	75.0	1

(Source: Study Team)

Calculation conditions

The totals of 16 points used for simulation were selected at the boundary of power plant site and another 5 points the nearly residences and commercial facilities were also selected for simulation.

The calculation was conducted at the same point as the one in Chapter 13.6.1 Construction

Phase. This calculation paid attention to the barrier effect of the geography of the western part of the site, as well.

Result of simulation

Table 13.6-10 shows the result of simulating the noise level for each sampling point during the operation of the plant equipment. Figure 13.6-15 shows the distribution of noise levels.
Noise level generated by power plant operation is 34 - 48dB (A) at the boundary of the power plant site and 38 - 45 dB (A) at the residence.

The noise levels at all the points satisfy the day-time and night-time noise level standard of Azerbaijan and IFC/WB guideline.
Maintenance of equipment will be conducted and low noise type equipment and adequate enclosures will be installed.
Noise influence on residential areas to the south of the site will be reduced with tree-planting around employees' house and the site boundary within the south of the site. Furthermore, sound insulating walls will be installed as necessary.

Table 13.6-10 Results of Simulating Noise Levels from the Power Plant

Place	Simulation Points	Noise Levels (dBA)	Azerbaijan Standard	IFC/WB EHS Guidelines: General
Project Boundary	No. 1	34	Day 65 Night 55	Day 70 Night 70
	No. 2	35		
	No. 3	36		
	No. 4	39		
	No. 5	43		
	No. 6	44		
	No. 7	48		
	No. 8	41		
	No. 9	48		
	No.10	45		
	No.11	42		
	No.12	39		
	No.13	44		
	No.14	46		
	No.15	41		
	No.16	43		
Commercial Facilities	No.17	47	-	Day 70 Night 70
Settlement	No.18	45	Day 55 Night 45	Day 55 Night 45

Place	Simulation Points	Noise Levels (dBA)	Azerbaijan Standard	IFC/WB EHS Guidelines: General
Commercial Facilities	No.19	45	-	Day 70 Night 70
Settlement	No.20	38	Day 55 Night 45	Day 55 Night 45
Settlement	No.21	39		Day 55 Night 45

Reference: Recommendations on Environment Protection in Road and Bridge Design, Moscow, 1995 and IFC/WB EHS Guidelines General, 2007

(Source: Study Team)

(Source: Study Team)

Figure 13.6-15 Results of Simulating Noise Level from Power Plant

<Vibration>

Vibration impact from the plant operation is predicted. There are residences near the project site, and sufficient consideration must be given to minimizing Vibration impact. The level of vibration resulting from the operation of the major equipment was simulated using the following estimation model.

Vibration level estimation model

An estimation of the vibration level was made according to Chapter 13.6.1 Construction Phase.

Vibration level data of Vibration source

The vibration source level generated from the generation facility is shown in gas turbine and steam turbine, generator and pump equipment

Table 13.6-11 shows the vibration level of the major equipment and the number of equipment.

Table 13.6-11 Vibration Level and the Number of the Major Equipment

Item	Equipment Type	Vibration Level at 1m from source (dB)	Number of Equipment
Power plant facility	Gas Turbine	65.0	2
	Generator	54.0	2
	Steam turbine	54.0	2
	Water pump	59.0	2
Utility facility	Circulation water pump	53.0	1

(Source: Study Team)

Calculation conditions

The totals of 16 points used for simulation were selected at the boundary of power plant site and another 5 points the nearly residences and commercial facilities were also selected for simulation.

The calculation was conducted at the same point as the one in Chapter 13.6.1 Construction Phase.

Result of simulation

Table 13.6-12 shows the result of simulating the vibration level for each sampling point during the operation of the plant equipment.

Vibration level generated by power plant operation is 0 - 25dB at the boundary of the power plant site and 6- 19 dB (A) at the residence.

The vibration levels at all points is low level and satisfy with standard of Japan.
Furthermore, all the predicted values are enough below the threshold level, around 50dB, at which human being can feel vibration. Almost all of them are also below the minimum measured level of vibration (25dB).
Buildings will be constructed with strong foundation.
Maintenance of equipment will be conducted and low vibration type equipment and adequate enclosures will be installed.

Table 13.6-12 Results of Simulating Vibration Levels from the Power Plant

Place	Simulation Points	Vibration Levels (dB)	Japanese Standard
Project Boundary	No. 1	0	Day 60 Night 55
	No. 2	3	
	No. 3	7	
	No. 4	12	
	No. 5	17	
	No. 6	23	
	No. 7	19	
	No. 8	24	
	No. 9	25	
	No.10	20	
	No.11	14	
	No.12	9	
	No.13	9	
	No.14	9	
	No.15	0	
	No.16	0	
Commercial Facilities	No.17	18	Day 60 Night 50
Settlement	No.18	15	Day 55 Night 45
Commercial Facilities	No.19	19	Day 60 Night 50
Settlement	No.20	6	Day 55 Night 45
Settlement	No.21	5	

(Source: Study Team)

6) Odor
In case domestic waste from the workers' camp is not appropriately treated, the rotting waste may produce a foul odor. Before starting the construction work, workers will be instructed to classify and collect garbage and illegal waste disposal will be prohibited. Garbage will be

disposed on a periodic basis to ensure that odor by putrefaction is not produced. These measures will be taken to minimize the generation of odor.

7) Substratum contamination

Sediment pollution may occur in the case power plant wastewater and domestic wastewater flows into the sea.

Wastewater will collect in wastewater treatment system. It will be managed and treated appropriately to comply with water quality regulations.

(2) Natural environment

1) Terrestrial ecosystem and rare species

The site has a small sandy beach. Herbs and shrubs are scarce. Loss of habitat of animals and vegetation is expected. However similar environment extends into surrounding broad sandy beach areas. Limited impact on the ecosystems is expected.

No precious species of flora/fauna inhabit the project site.

Power plant will generate air pollution, noise and vibration, etc. that will have impact on the terrestrial ecosystems. However, the range of such impact will be very limited.

Mitigation measures for air pollution, noise and vibration will be implemented.

Bird hunting by workers shall be prohibited. The south of the site near the employees' house and the site boundary is vegetated with plants living in the surrounding coast or plant species resistant to salt damage.

2) Marine ecosystems and rare species

Taking in organisms by cooling water intake, pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of thermal water are expected to have impact on marine organisms.

Cooling water shall be taken at the low rate to minimize intake of fish and other marine organisms. Smaller fish in the sea area have sufficient swimming ability in comparison to the flow rate of water intake, and it is considered they will not be affected as a consequence.

Plankton is likely to die and damage from water intake because of no mobility. However, according to the biological monitoring results conducted over 30 years at a power plant in Japan, relatively-prompt reproduction of plankton was observed and little impact on plankton was ensured.

Water intake/discharge method shall be selected to minimize the area of water temperature rise.

According to the diffusion simulation, the area of 5^{o} C or higher temperature rise is 100m from the water outlet, which is very limited, and well meets the environmental standard (500m) of Azerbaijan.

Results of monitoring in Japan also reported that fish can avoid unfamiliar water temperature with their mobility. Conversely, there are many reports on species which gather around outfall. Benthonic organisms and sea grass without mobility will be affected most significantly. This impact can be seen only in range of a more than three degree rise in water temperature near outfall and there is no impact in areas of a less than three degree water temperature rise.
There are accumulations of Zostera noltii on the coastal line. In the area 300m offshore from the outfall, more than five degree rise ranges between 0m and 1m deep and more than three degree rise ranges between 0m and 2m. Namely, this area of the temperature rise does not reach the sea grass so the impacts can be localized.
If sea grass will widely disappear by thermal water, creation of see grass bed will be conducted for fishes and benthos with cooperation of MENR.

All waste water is treated at the treatment system so that the concentration of pollutant in waste water meets the standard of IFC/WB EHS Guidelines and other standards before discharge.

2) Marine hydrology
Because cooling water will be intake and discharged, there will be changes in flow conditions in the vicinities of the discharged.

The thermal effluent calculation includes the flow rate change estimation. The existing and future water flow speed distribution is shown in Figure 13.6-16.
Water temperature rise due to condenser shall be maintained ⊿9°C to minimize the amount of cooling water. Water shall be taken at the low rate of 0.2m/s which is not much faster compared with the current speed in the present marine area. That means water flow change will not be affected by water intake.
According to the flow rate change estimation, the flow speed at the point about 100m away from the water outlet is almost same as the surrounding speed. Therefore, the environmental impact will be localized.

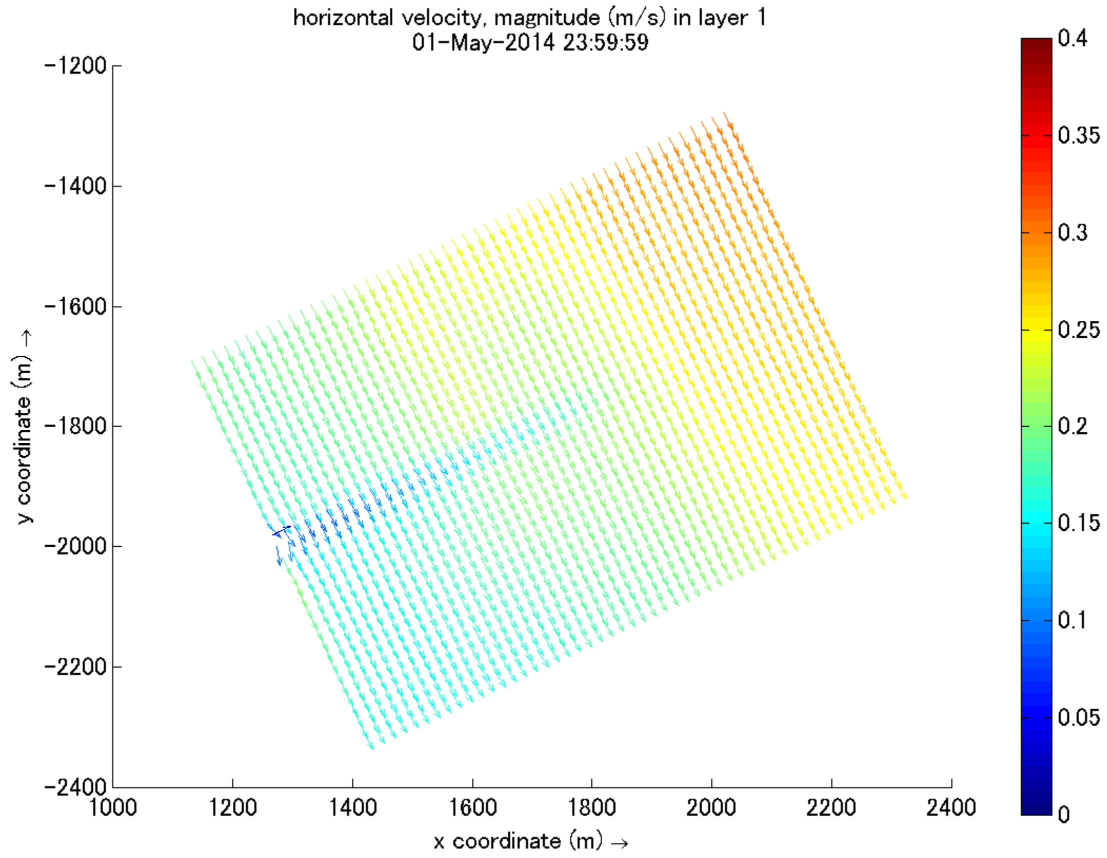


Figure 13.6-16(1) Flow Condition without Thermal Effluent (The present : Current speed 0.3m/s: SE)

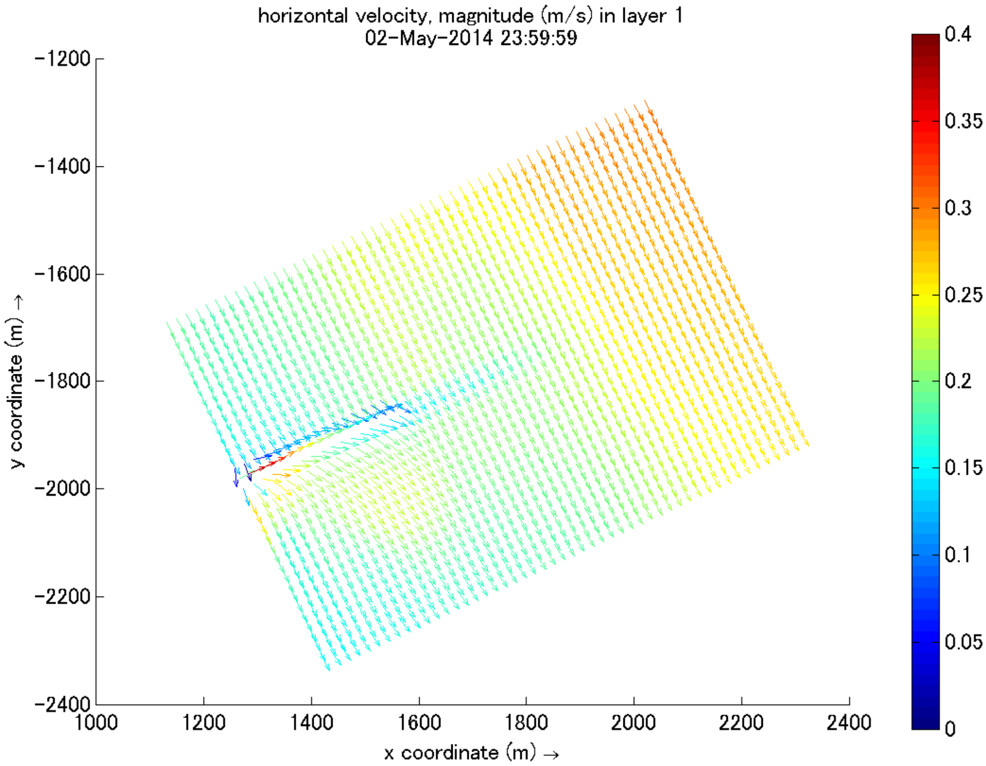


Figure 13.6-16(2) Flow Condition with Thermal Effluent (The future : Current speed 0.3m/s: SE)

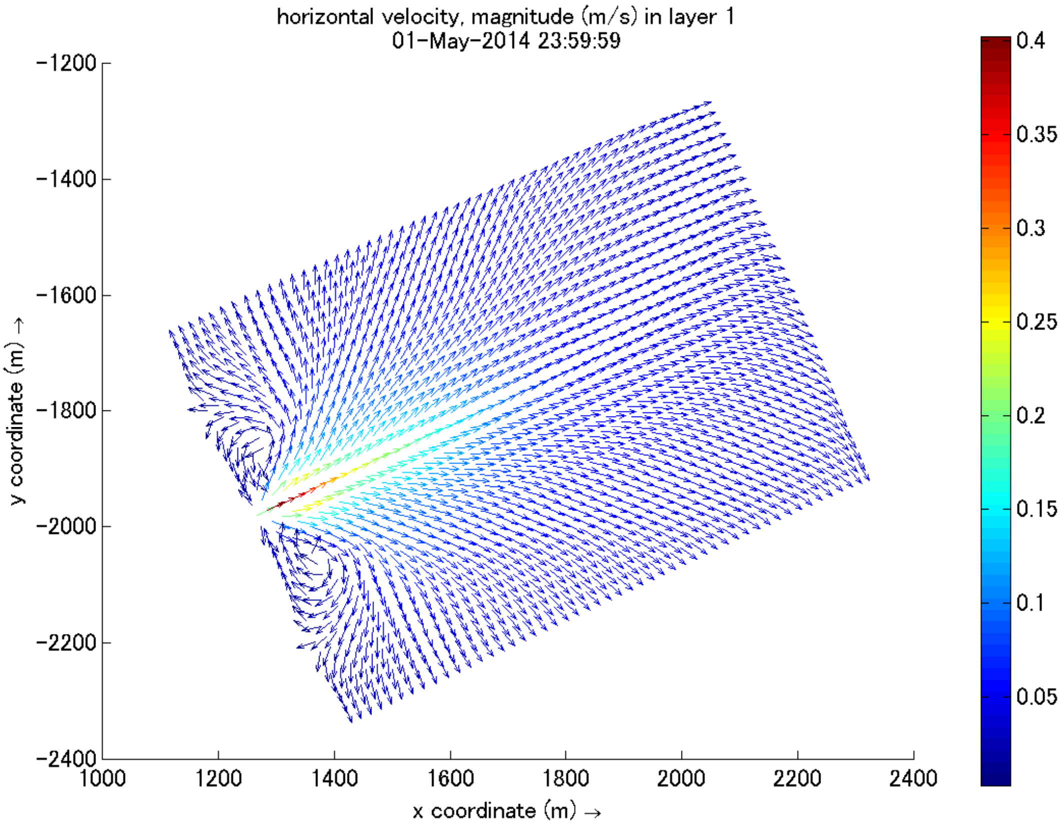


Figure 13.6-16(3) Flow Condition with Thermal Effluent (Current speed 0m/s)

(3) Social environment

1) Local economy including employment and means of livelihood

Since the site is governmental land and not been used for farmland and residential area, .the operation will have no impact.

Local people may be employed as workers by the power plant. It may purchase materials and equipment items in the local area.

Project proponent will employ local residents as many as possible and use of the services (i.e. laundry and catering service etc.) and products offered in the local community, as possible.

Job training will be provided as necessary for new employees.

2) Water use

There are few large ships at the sea with shoals in front of the plant, where water depth gets 7m around 1.3km off the coast.

The fishing in front of the project site is prohibited. In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore.

Installation of water taking and discharging facilities and changes in flow conditions may have impact on navigation of small boats of recreational fishing.

Water shall be taken at the low rate of 0.2m/s which is not much faster compared with the current speed in the present marine area. That means water flow change will not be affected by water intake.

According to the flow rate change estimation by the discharged thermal water, the flow speed at the point about 100m away from the water outlet is almost same as the surrounding speed. Therefore, the environmental impact will be localized.

The location of offshore water intake and water discharge shall be marked with a buoy installed around the equipment.

Taking organisms by cooling water intake, pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of Thermal water may cause impact on the recreational fishing.

Cooling water shall be taken at the low rate to minimize intake of fish and other marine organisms. Water intake/discharge method shall be selected to minimize the area of water temperature rise.

According to the diffusion simulation of thermal water, the area of 5^{o} C or higher temperature rise is very limited, and well meets the environmental standard of Azerbaijan.

All waste water is treated at the treatment system so that the concentration of pollutant in waste water meets the standard of IFC/WB EHS Guidelines and other standards before discharge.

3) Existing social infrastructure and social service

Lodging houses, medical treatment facilities, sewer systems and other infrastructure may be needed for workers.

The housing for the workers shall be organized within the site.

In the period of regular maintenance in which larger number of workers are expected, properly control maintenance schedule and processes and the traffic control plan including route-setting will be conducted

4) Unfair distribution of damage and benefit

If employing local people and/or outsourcing contracts are not fair, benefit may be unfairly distributed.

The employment of the local people shall be conducted under publicized employment conditions to prevent unfair employment.

5) Work environment (including labor safety)

Workers may have accidents during service.

Project proponent will develop the safety and sanitation management plan and implement the regular medical checkup.

Project proponent will subcontract a security firm to deploy security guards.

(4) Other

1) Accident

Fire and traffic accidents by operation of facilities and / or vehicles may be occurred.

Project proponent will develop gas-leakage prevention management plan. Gas-leakage alarm system and fire-fighting facility will be installed.

The land transportation at the periodic inspection shall be basically conducted using the existing highways and other roads.

2) Impact across the borders and on climatic change

CO_2 is produced by the project operation, but with high-efficiency CCPP, CO_2 generation per kWh is lower than in the conventional power generation system and the cross-boundary pollution and impact on climate change will be little.

13.6.3 Evaluation of Environmental Impacts

The results of environmental impact assessment are summarized in Table13.6-13.

Table 13.6-13 The Result of Environmental Assessment (Thermal Power Plant)

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
【Pollution】										
1	Air pollution	N	B	N	A	N	B	N	B	**During construction:** Civil engineering work, such as land formation, may cause dust, while heavy equipment and trucks are likely to discharge air pollutants (SOx, NOx, etc.). Water sprinkling, maintenance of construction machines and other measures shall be conducted. **During operation:** Operation of the power plant will emit NOx. However, NOx concentration in exhaust gas meets the standard of IFC/WB EHS Guidelines and other standards. According to the atmospheric diffusion simulation, the maximum concentration at ground level was complied with Environmental standard of Azerbaijan as well as IFC/WB EHS Guidelines.
2	Water pollution	N	B	N	A	N	B	N	B	**During construction:** Muddy water will be generated during dredging work and land formation excavation. During construction, waste water from concrete and oil-containing waste water will be generated. Dredging method generating less turbidity will be adopted and all waste water will be treated by the treatment system before discharge. **During operation:** During operation, Thermal water, plant wastewater, domestic waste water and oil-containing waste water will be generated. Cooling water shall be taken from a lower water layer 6m deep where water temperature is low, 1.3km from the coast, and discharged at the high rate of 2.5m/s from the coast near the project site to minimize the area of water temperature rise. According to the diffusion simulation, the area of 5^{o} C or higher temperature rise is 100m from the water outlet, which is very limited, and well meets the environmental

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
										standard (500m) of Azerbaijan. All waste water is treated at the treatment system so that the concentration of pollutant in waste water meets the standard of IFC/WB EHS Guidelines and other standards before discharge.
3	Waste	N	B	N	B	N	B	N	B	**During construction:** The construction work will generate general waste and hazardous waste. Project proponent will arrange for the development of including education of workers to encourage reduction and reuse of waste. Specifically, paper wastes and iron scraps will be recycled. Other general wastes will be collected by Sumgayit city and carried to existing disposal fields. All of the hazardous waste will be disposed by a waste management company approved by the government at disposal fields in Sumgayit which are permitted by the government in accordance with the Azerbaijan legislation. **During operation:** General waste and hazardous waste will be generated. Project proponent will arrange for the development of including education of workers to encourage reduction and reuse of waste. Specifically, paper wastes and iron scraps will be recycled. Other general wastes will be collected by Sumgayit city and carried to existing disposal fields. All of the hazardous waste will be disposed by a waste management company approved by the government at disposal fields in Sumgayit which are permitted by the government in accordance with the Azerbaijan legislation.
4	Soil pollution	N	B	N	B	N	B	N	B	**During construction:** Lubrication oil and fuel, etc. spilled from construction vehicles and construction machinery, etc. are likely to cause contamination in the soil. Project proponent will store oil and chemical materials in a storage site and method to prevent permeation into ground

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
										During operation: Lubrication oil and fuel spilled during operation of the power plant are likely to cause contamination in the soil. Project proponent will store oil and chemical materials in a storage tank and area with dyke of concrete and method to prevent permeation into ground.
5	Noise and vibration	N	B	N	A	N	B	N	B	**During construction:** Operation of heavy equipment and trucks will cause impact from the temporary noise and vibration. In particular, pile driving will cause impact from the strong noise and vibration into surrounding broader areas. According to the noise level simulation result, the noise level in the residential area meets the standard of Azerbaijan for daytime noise as well as IFC/WB EHS Guidelines. According to the vibration level simulation result, the vibration level in the residential area are low level and enough below the threshold level (50dB) which human being can feel. Temporal noise insulation fences will be installed around the site as necessary. **During operation:** According to the noise level simulation result, the noise level in the residential area meets the standard of Azerbaijan as well as IFC/WB EHS Guidelines. Noise influence on residential areas to the south of the site will be reduced with tree-planting around employees' house and the site boundary within the south of the site. Furthermore, sound insulating walls will be installed as necessary. According to the vibration level simulation result, the vibration level are also below the minimum measured level of vibration (25dB).
6	Land subsidence	N	N	N	N	N	N	N	N	**During construction and operation:** Water will not be drawn up from underground.
7	Odor	N	B	N	B	N	B	N	B	**During construction and operation:** If living waste at worker stations is handled improperly, the discarded waste may cause bad smell.

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Constructi on period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
										Project proponent will arrange for the development of including education of workers to encourage reduction and reuse of waste.
8	Substratum contamination	N	B	N	B	N	B	N	B	**During construction and operation:** If untreated waste water is discharged, it will cause substratum contamination. All waste water generated during construction and operation phase is treated at the treatment system before discharge.
【Natural environment】										
1	Wild life preservation area	N	N	N	N	N	N	N	N	**During construction and operation:** The site is located in no wild life preservation area and has no such nearby area.
2	Terrestrial ecosystems and rare species	N	C	N	C	N	B	N	B	**During construction and operation:** The site has a small sandy beach. Herbs and shrubs are scarce. Loss of habitat of animals and vegetation is expected. However similar environment extends into surrounding broad sandy beach areas. Limited impact on the ecosystems is expected. Construction and operation of power plant will generate air pollution, noise and vibration, etc. that will have impact on the terrestrial ecosystems. However, the range of such impact will be very limited No precious species of flora/fauna inhabit the project site. Mitigation measures for air pollution, noise and vibration will be implemented. Bird hunting by workers shall be prohibited. The plant site is vegetated with plants living in the surrounding coast or plant species resistant to salt damage.
3	Marine ecosystems and rare species	N	C	N	C	N	B	N	B	**During construction:** The dredging work for cooling water facilities and land reclamation are likely to generate muddy water. Dredging method generating less turbidity will be adopted. Waste water from the construction activity will be treated by the treatment system before discharge. If sea grass will widely disappear by construction activities, creation of see grass bed will be conducted for fishes and benthos with cooperation of MENR. **During operation:** Taking in organisms by cooling water intake,

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
										pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of thermal water are expected to have impact on marine organisms. Cooling water shall be taken at the low rate to minimize intake of fish and other marine organisms. Water intake/discharge method shall be selected to minimize the area of water temperature rise. According to the diffusion simulation, the area of 5° C or higher temperature rise is 100m from the water outlet, which is very limited, and well meets the environmental standard (500m) of Azerbaijan. All waste water is treated at the treatment system so that the concentration of pollutant in waste water meets the standard of IFC/WB EHS Guidelines and other standards before discharge. If sea grass will widely disappear by thermal water, creation of see grass bed will be conducted for fishes and benthos with cooperation of MENR.
4	River ecosystem	N	N	N	N	N	N	N	N	**During construction and operation:** The site has no rivers inside.
5	River hydrology	N	N	N	N	N	N	N	N	**During construction and operation:** The site has no nearby rivers. Water will not be drawn up from rivers.
6	Underground hydrology	N	N	N	N	N	N	N	N	**During construction and operation:** Water from underground will not be drawn up during these operations.
7	Marine hydrology	N	N	N	B	N	N	N	B	**During construction:** Since no port and harbor facilities will be constructed, there will be no change in flow conditions. **During operation:** Because cooling water will be intake and discharged, there will be changes in flow conditions in the vicinities of the discharged. Water temperature rise due to condenser shall be maintained ⊿9° C to minimize the amount of cooling water. Water shall be taken at the low rate of 0.2m/s. According to the flow rate change estimation, the flow rate is nearly the same as the surrounding water flow at 300m from the

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
										water outlet, and the environmental impact will be insignificant.
8	Topography and geology	N	N	N	N	N	N	N	N	**During construction and operation:** Since the site will have no port and harbor facilities, no change will take place in the coast.
【Social environment】										
1	Resettlement and Land acquisition	N	N	N	N	N	N	N	N	**During construction and operation:** Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact.
2	Poor People	N	N	N	N	N	N	N	N	**During construction and operation:** There is no minority group living around the project site.
3	Ethnic minorities	N	N	N	N	N	N	N	N	There are no minority groups living around the project site.
4	Local economy including employment and means of livelihood	B	N	B	N	B	N	B	N	**During construction and operation:** Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact. Local people may be employed as workers by the power plant. It may purchase materials and equipment items in the local area. Especially in the construction phase, project proponent will employ local residents as many as possible and use of the services (i.e. laundry and catering service etc.) and products offered in the local community, as possible Job training will be provided as necessary for new employees.
5	Land use and utilization of local resources	N	N	N	N	N	N	N	N	**During construction and operation:** Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact.
6	Water use	N	B	N	B	N	B	N	B	**During construction:** There are few large ships at the sea with more shoals in front of the plant, where water depth gets 7m around 1.3km off the coast. The fishing in front of the project site is prohibited, In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
										Muddy water may be generated from dredging work and land reclamation and excavation work, resulting in impact on the recreational fishing. Public awareness will be conducted as dredging plans and construction schedule among the local peoples **During operation**： There are few large ships at the sea with more shoals in front of the plant, where water depth gets 7m around 1.3km off the coast. The fishing in front of the project site is prohibited, In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore. Installation of water taking and discharging facilities and changes in flow conditions may have impact on navigation of small boats of recreational fishing. Water shall be taken at the low rate of 0.2m/s which is not much faster compared with the current speed in the present marine area. That means water flow change will not be affected by water intake. According to the flow rate change estimation by the discharged thermal water, the flow speed at the point about 100m away from the water outlet is almost same as the surrounding speed. Therefore, the environmental impact will be localized. The location of offshore water intake equipment shall be marked with a buoy installed around the equipment. Taking organisms by cooling water intake, pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of Thermal water may cause impact on the recreational fishing. Cooling water shall be taken at the low rate to minimize intake of fish and other marine organisms. Water intake/discharge method shall be selected to minimize the area of water temperature rise. According to the diffusion simulation of thermal water, the area of 5^{o} C or higher temperature rise is very limited, and well meets the environmental standard of

No.	Items	Assessment at the scoping: Construction period: Positive	Assessment at the scoping: Construction period: Negative	Assessment at the scoping: Operation period: Positive	Assessment at the scoping: Operation period: Negative	Assessment based survey results: Construction period: Positive	Assessment based survey results: Construction period: Negative	Assessment based survey results: Operation period: Positive	Assessment based survey results: Operation period: Negative	Reason for assessment
										Azerbaijan. All waste water is treated at the treatment system so that the concentration of pollutant in waste water meets the standard of IFC/WB EHS Guidelines and other standards before discharge.
7	Existing social infrastructure and social service	N	B	N	B	N	B	N	B	**During construction**: Inflows of workers may need to build lodging houses, medical treatment facilities, sewer systems and other infrastructure. Especially in the construction phase, project proponent will employ- as possible. Workers coming from other than the local area shall be accommodated in the rented housing in the surrounding area to minimize the area of the worker's camp. Traffic during construction is expected to increase. Project proponent will conduct the traffic control plan including route-setting and training safe operation of vehicles. **During operation:** Lodging houses, medical treatment facilities, sewer systems and other infrastructure may be needed for workers. The housing for the workers shall be organized within the site. Properly control maintenance schedule and processes and the traffic control plan including route-setting will be conducted in the period of regular maintenance in which larger number of workers are expected.
8	Social bodies including society-related capitals and social organizations that make local decisions	N	N	N	N	N	N	N	N	**During construction and operation:** Since the site is governmental land and not been used for farmland and residential area. Thus, it will foresee no relations with social bodies, such as local bodies that make decisions on matters including relocation of local people.
9	Unfair distribution of damage and benefit	N	B	N	B	N	B	N	B	**During construction and operation:** If employing local people and/or outsourcing contracts are not fair, benefit may be unfairly distributed. The employment of the local people shall be conducted under publicized employment conditions to prevent unfair employment.

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
10	Conflict of interests within the local area	N	N	N	N	N	N	N	N	**During construction and operation:** Since the site is governmental land and not been used for farmland and residential area, conflict of interests is not expected to take place within the local area.
11	Cultural heritage	N	N	N	N	N	N	N	N	**During construction and operation:** Since the surroundings of the site have no scenic spots, no impact is expected.
12	Landscape	N	N	N	N	N	N	N	N	**During construction and operation:** No particular impact is expected to take place on the gender.
13	Gender	N	N	N	N	N	N	N	N	**During construction and operation:** No particular impact is expected to take place on the gender.
14	Rights of children	N	N	N	N	N	N	N	N	**During construction and operation:** No particular impact is expected to take place on rights of children.
15	HIV/AIDS and other infectious diseases	N	B	N	N	N	B	N	N	**During construction:** Inflows of foreign workers may spread such infectious diseases. Installation of medical center and implementation of periodic medical check , education and training on health care of the workers will be conducted. **During operation:** Inflows of foreign workers may be few.
16	Work environment (including labor safety)	N	B	N	B	N	B	N	B	**During construction and operation:** Workers may have accidents during service. Project proponent will develop the safety and sanitation management plan and implement the regular medical checkup. Project proponent will subcontract a security firm to deploy security guards.
【Others】										
1	Accidents	N	B	N	B	N	B	N	B	**During construction:** Traffic accidents may occur during operation of vehicles. Large machines shall be transported through the sea to the possible extent. Land transportation shall use the existing highways and other existing roads shall be used as much as possible. **During operation:** Fire and Traffic accident by operation of facilities and/or vehicles. Project proponent will develop gas-leakage prevention management plan Gas-leakage alarm system and fire-fighting

No.	Items	Assessment at the scoping				Assessment based survey results				Reason for assessment
		Construction period		Operation period		Construction period		Operation period		
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	
										facility will be installed. The land transportation at the periodic inspection shall be basically conducted using the existing highways and other roads.
2	Cross-boundary Impact and Climate Change	N	B	N	B	N	B	N	B	**During construction:** CO_2 is generated during construction, but the impact is limited to a temporal period. Periodic checkup and maintenance of heavy machine and Vehicles. - Although Caspian Sea is an international lake, implementation of this project only requires procedures in accordance with Azerbaijan legislations and does not require procedures for neighboring nations. **During operation:** CO_2 is produced by the project operation, but with high-efficiency CCPP, CO_2 generation per kWh is lower than in the conventional power generation system and the cross-boundary pollution and impact on climate change will be little. - Although Caspian Sea is an international lake, implementation of this project only requires procedures in accordance with Azerbaijan legislations and does not require procedures for neighboring nations.

Notes: The categorization criteria are as follows.

A: causes serious impact.

B: causes certain degree of impact.

C:The extent of impact will be uncertain. (A further survey will be needed to make the expected impact clear.)

N: No impact is expected.

(Source: Study Team)

13.7 Environmental Management Plan (Mitigation Measures)

13.7.1 Construction Phase

(1) Implementation system

At the construction phase, the Project Institution Unit (PIU) / Yashma power plant shall carefully consider the construction activity with supervision consultant and encourage the EPC contractor to well understand the necessary mitigation measures and to implement them.

In this regard, an environmental management unit shall be organized prior to the construction activity and an expertized environmental management administrator shall be placed. The unit will discuss and prepare the mitigation measures with supervision consultant and the EPC contractor prior to the construction activity.

During construction activity in which large inflow of workers and vehicles is predicted, the environmental management unit shall regulatory promote the understanding of the surrounding community by consultation meeting and bulletin board about the contents and schedule of the construction activity and mitigation measures.

Moreover, the environmental management unit shall also function as a grievance organization to understand and address opinions and grievances from local residents during construction phase, and conduct appropriate mitigation measures.

The bulletin board and public meeting provide residents with contact information for grievances from local residents

In order to confirm the implementation of the environmental management and to consider further mitigation measures, the EPC contractor should submit a regular report to the supervision consultant and environmental management unit on the implementation status of the management plan.

The environmental management administrator shall regularly conduct explanation to the local people and submit a report to MENR, JICA and other relevant organizations about the implementation status of the environmental management, in addition to the environmental monitoring described hereinafter.

Figure 13.7-1 describes the environmental management and monitoring implementation structure with the reporting flow in construction phase.

2) Mitigation measures

The major environmental impact, mitigation measures, responsible organization and expense for each environmental item in construction phase are listed in Table 13.7-1.

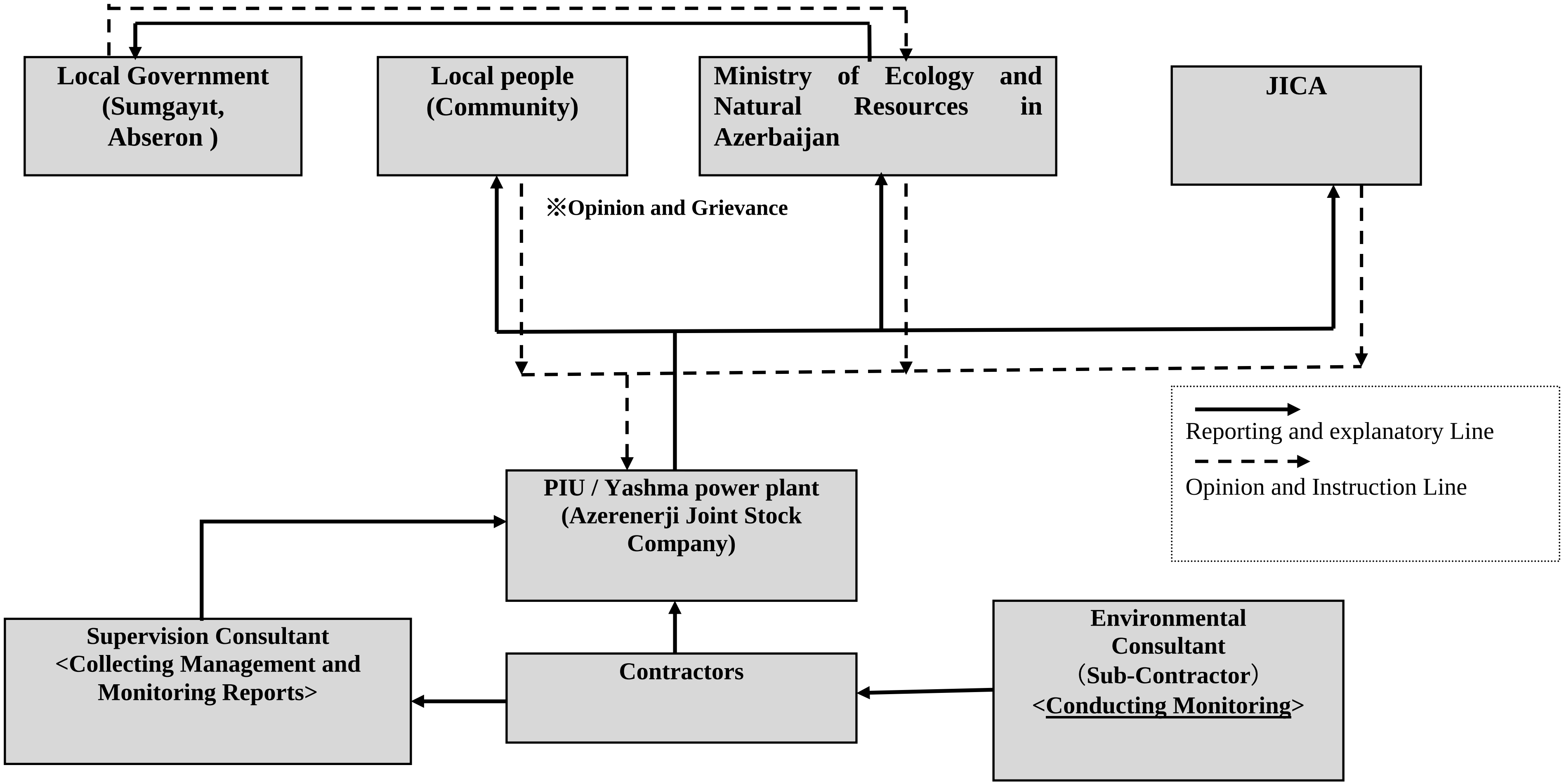


Figure 13.7-1 Environmental Management and Monitoring Implementation Structure in Construction Phase

Table 13.7-1 Environmental Impact during Construction Phase and Mitigation Measures

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
Construction phase					
Air pollution	- Civil engineering work, such as land formation, may cause dust, while heavy equipment and trucks are likely to discharge air pollutants (SOx, NOx, etc.).	- Rationalization of construction schedule: minimize heavy machine operation and material transportation - Periodic checkup and maintenance of heavy machine and vehicles - Shutdown of engine during waiting time - The rear deck of the sand-transport trucks shall be covered - Periodic car wash - Periodic watering of the site and surrounding road with the observation of dust caused by the strong winds, - Monitoring ambient air quality in the residential area compared to the standard of IFC/WB EHS Guidelines	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Water pollution and Substratum contamination	- Muddy water will be generated during dredging work and land formation excavation. - During construction, domestic waste water and oil-containing waste water will be generated. - If untreated waste water is discharged, it will cause substratum contamination.	- Installation of temporary rainwater drainage - Installation of temporary sedimentation pond and oil-separating system - Installation of septic tank and temporary toilet - To choose dredging method and equipment to that will minimize the turbidity, as use of the silt fence or sheet, dredging pump etc. are installed. - Dredged soil is not dumped into the sea, but used for embankment within the site. - Monitoring of sea water quality compared to the standard of Azerbaijan	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Waste and Odor	- The construction work will generate general waste and hazardous waste. - If untreated waste water is discharged, it will cause substratum contamination.	- Development of waste management program including education of workers to encourage reduction and reuse of waste - Prohibition of illegal dumping - Separation of waste by waste type, storage in an appropriate storage site and legal disposal in an appropriate disposal site -Specifically, paper wastes and iron scraps will be recycled. Other general wastes will be collected by Sumgayit city and carried to existing disposal fields. - All of the hazardous waste will be disposed by a waste management company approved by the government at disposal fields in Sumgayit which are permitted by the government in accordance with the	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
		Azerbaijan legislation. - The record of the amount of generated waste and the disposal site			
Soil contamination	- Lubrication oil and fuel, etc. spilled from construction vehicles and construction machinery, etc. are likely to cause contamination in the soil.	- Storage of oil and chemical materials in a storage site and method to prevent permeation into ground	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Noise and vibration	- Operation of heavy equipment and trucks will cause impact from the temporary noise and vibration. In particular, pile driving will cause impact from the strong noise and vibration into surrounding broader areas.	- Rationalization of construction schedule: minimize heavy machine operation and material transportation - Periodic checkup and maintenance of heavy machine and vehicles - Construction activity and traffic of vehicles is essentially limited to daytime - Use low-noise/vibration type equipment - Temporary soundproof wall around the project site, if need - Piling is not conducted. - Monitoring of noise level at site boundary and the residential area compared to the standard of Azerbaijan and IFC/WB EHS Guidelines	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Terrestrial ecosystem and rare spccies	- Loss of habitat of animals and vegetation is expected. - Air pollution, noise and vibration may be generated during construction	- The alteration of the site should be requisite minimum. - Rationalization of construction schedule: minimize heavy machine operation and material transportation - Periodic checkup and maintenance of heavy machine and vehicles - The rear deck of the sand-transport trucks shall be covered - Periodic car wash - Periodic watering of the site and surrounding road with the observation of dust caused by the strong winds, - Use low-noise/vibration type equipment - Piling is not conducted. -Bird hunting by workers shall be prohibited. -The plant site is vegetated with plants living in the surrounding coast or plant species resistant to salt damage.	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Marine ecosystems and rare species	- The dredging work for cooling water facilities and land reclamation are likely to generate muddy water.	- Installation of temporary rainwater drainage - Installation of temporary sedimentation pond and oil-separating system - Installation of septic tank and temporary toilet	Continuously	Implementation; EPC Contractor, Environmental consultant	Expense is included in EPC contract cost by EPC Contractor.

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
		- To choose dredging method and equipment to that will minimize the turbidity, as use of the silt fence or sheet, dredging pump etc. are installed. - Dredged soil is not dumped into the sea, but used for embankment within the site. - Monitoring of sea grass in the shallow water area surround outlet. - If sea grass will widely disappear by construction activities, creation of see grass bed will be conducted for fishes and benthos with cooperation of MENR.		Supervisor-consultant, PIU	
Local economy including employment and means of livelihood, Unfair distribution of damage and benefit	During construction and operation: - Since the site is governmental land and not been used for farmland and residential area, .the construction and operation will have no impact. Local people may be employed as workers by the power plant. It may purchase materials and equipment items in the local area. - If employing local people and/or outsourcing contracts are not fair, benefit may be unfairly distributed.	- Employment of local residents as many as possible. - Use of the services (i.e. laundry and catering service etc.) and products offered in the local community, as possible - Provision of job training for employment, if need - The employment of the local people shall be conducted under publicized employment conditions.	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Water use	- Muddy water may be generated from dredging work and land reclamation and excavation work, resulting in impact on the recreational fishing.	- Installation of temporary rainwater drainage - Installation of temporary sedimentation pond and oil-separating system - Installation of septic tank and temporary toilet - To choose dredging method and equipment to that will minimize the turbidity, as use of the silt fence or sheet, dredging pump etc. are installed. - Dredged soil is not dumped into the sea, but used for embankment within the site. - Monitoring of sea water quality compared to the standard of Azerbaijan - Public awareness of dredging plans and construction schedule among the local people	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
Existing social infrastructure and social service	- Inflows of workers may need to build lodging houses, medical treatment facilities, sewer systems and other infrastructure. - Traffic during construction is expected to increase.	- Employment of local residents as many as possible. - The rented houses in the surrounding area shall be used as much as possible. - Construct worker's camp with medical center and sewer systems, as required. - Properly control construction schedule and processes. - Determine the traffic control plan including route-setting - Training safe operation of vehicles.	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
HIV/AIDS and other infectious diseases	- Influx of workers may generate infectious disease, HIV, conflict with local residents	- Installation of medical center and implementation of periodic medical check - Education and training on health care of the workers	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Work environment (including labor safety)	- Workers may have accidents during service. - Security guards may infringe on the security of surrounding people.	- Compliance of safety regulations and laws - Development of a safety and sanitation management plan - Establish a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices such as cranes are appropriate for the expected load. - Keep them well maintained and perform maintenance checks as appropriate during the period of construction.	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Accident	- Traffic accidents may occur during operation of vehicles.	- Large machines shall be transported through the sea to the possible extent. - Land transportation shall use the existing highways and other existing roads shall be used as much as possible. - In case of using the roads in the residential area, traffic of construction vehicles during school commuting hours shall be avoided - Checking of traffic regulations, installation of traffic signs, driving safety education, speed restriction, checkup of vehicle equipment (brake, horn)	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
Impact across the borders and on	Temporary emission of CO_2 from heavy machines and vehicles	- Rationalization of construction schedule: minimize heavy machine operation and material transportation	-Before starting construction	Implementation; EPC Contractor,	Expense is included in EPC contract cost

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
climatic change		- Periodic checkup and maintenance of heavy machine and vehicles	activity -Continuously	Environmental consultant Supervisor-consultant, PIU	by EPC Contractor.

13.7.2 Environmental Management Plan during Operation Phase

1) Implementation system
Yashma power plant is responsible for organizing an environmental management unit to develop and implement the environmental management plan as a mitigation measures.

An expertized environmental management administrator shall be placed so that the environmental management plan is appropriately implemented.

The environmental management administrator shall enhance the understanding of the environmental management plan to the project staffs prior to the operation, and continue regular education of the staffs during operation phase.

The environmental management unit shall also function as a grievance organization to understand and address the grievance from the local people during operation phase, and conduct appropriate mitigation measures.

Basic policy of the environmental management plan is to coordinate with the local community, and sufficient explanation of the positive mitigation measures for the local people is very important. It may be useful to have consultation meetings with local residents, to invite the local residents and school children to a visiting tour of the high-technology power station in the future.

If there are requests from residents, consultation meeting will be carried out. The bulletin board and public meeting provide residents with contact information for the grievance from the local people
The administrator shall report the contents and implementation status of the environmental management plan and the environmental monitoring plan described below to the director of the plant, and the director shall take final responsibility.

The environmental management administrator shall regularly conduct explanation to the local people and submit a report to MENR, JICA and other relevant organizations about the implementation status of the environmental management, in addition to the environmental monitoring described hereinafter.
Figure 13.7-2 describes the environmental management and monitoring implementation structure with the reporting flow in operation phase.

2) Mitigation measures
The major environmental impact, mitigation measures, responsible organization, and expense for each environmental item in operation phase are listed in Table 13.7-2.

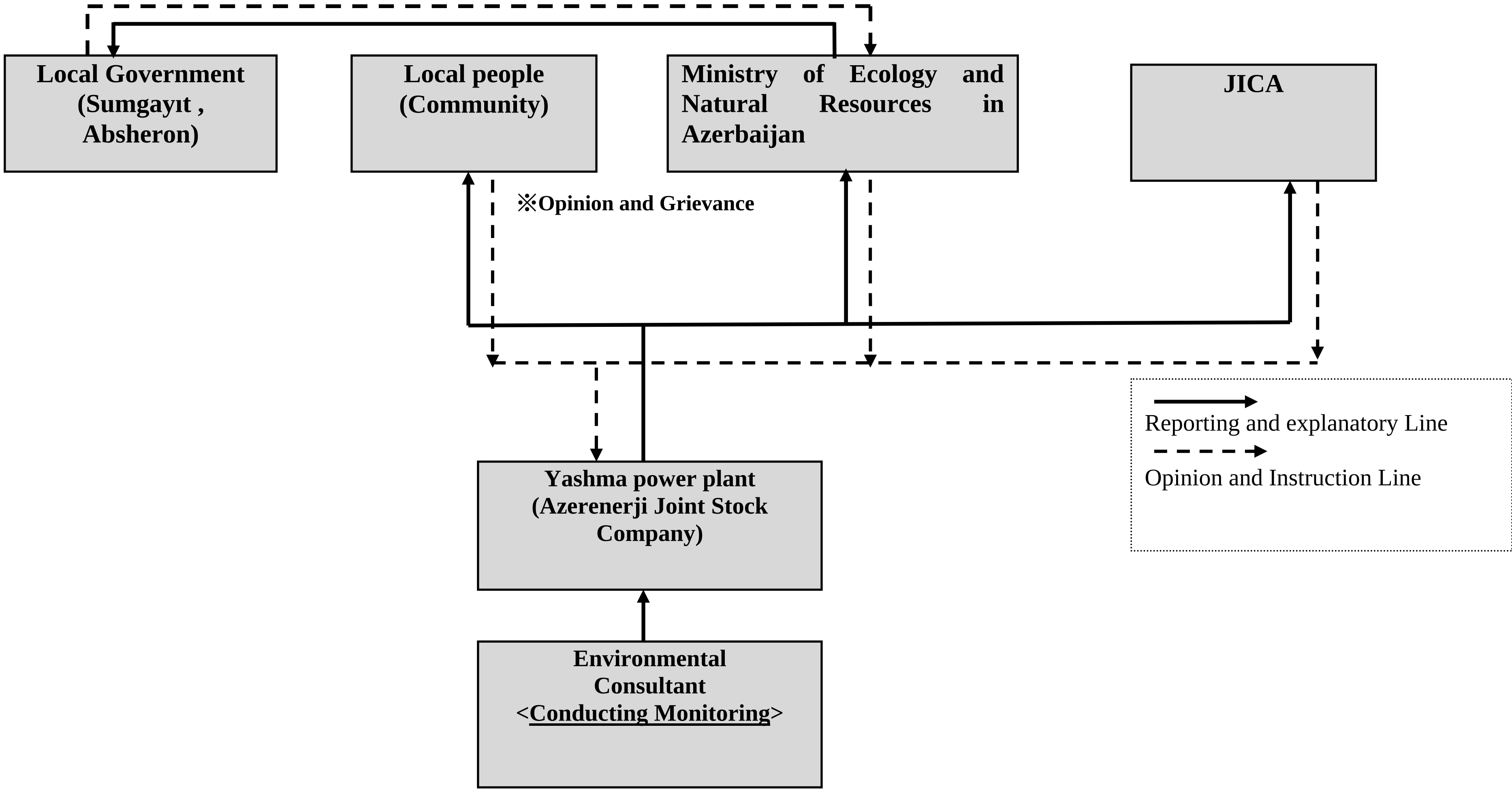


Figure 13.7-2 Environmental Management and Monitoring Implementation Structure in Operation Phase

Table 13.7-2 Environmental Impact during Operation Phase and Mitigation Measures

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
Operation phase					
Air pollution	- Operation of the power plant will emit NOx.	- Introduction of low NOx combustion appliances - Use of high stack - Monitoring exhaust gas and ambient air in the residential area compared to the standard of Azerbaijan and IFC/WB EHS Guidelines	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant Equipment's Budget including to EPC contract cost
Water pollution and Substratum contamination	Thermal water, plant wastewater, domestic waste water and oil-containing waste water will be generated. - If untreated waste water is discharged, it will cause substratum contamination.	- In order to minimize the area of water temperature rise, cooling water shall be taken from 1.3km from the coast and a lower water layer 6m deep where water temperature is low, and be discharged at the high rate of 2.5m/s from the coast near the project site. - Installation of water treatment facility - Drain system will be introduced to gather oily rain water - Monitoring of thermal water ,wastewater and sea water compared to the standard of Azerbaijan and IFC/WB EHS Guidelines	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant Equipment's Budget including to EPC contract cost
Soil contamination	- Lubrication oil and fuel spilled during operation of the power plant are likely to cause contamination in the soil.	- Storage of oil and chemical materials in a storage site and method to prevent permeation into ground	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant
Waste and Odor	- General waste and hazardous waste will be generated. -If living waste is handled	- Prohibition of illegal dumping - Return waste oil to the suppliers to treat it appropriately - Separation of waste by hazard level, storage in an	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
	improperly, the discarded waste may cause bad smell.	appropriate sites and legal disposal in an appropriate disposal site -Specifically, paper wastes and iron scraps will be recycled. Other general wastes will be collected by Sumgayit city and carried to existing disposal fields. All of the hazardous waste will be disposed by a waste management company approved by the government at disposal fields in Sumgayit which are permitted by the government in accordance with the Azerbaijan legislation. - The record of the generation amount of waste and the disposal site.			
Noise and vibration	-Operation of the plant will cause impact from the noise and vibration.	- Use low-noise equipment - Use of GT enclosure, GT intake silencer, turbine building, pomp building - Use of low-vibration equipment - Construction of buildings with strong foundation - Regular maintenance of the equipment - The south of the site near the employees' house and the site boundary is vegetated with plants living in the surrounding coast or plant species resistant to salt damage. - Monitoring of Noise level at site boundary and the residential area compared to the standards of Azerbaijan and IFC/WB EHS Guidelines - Furthermore, sound insulating walls will be installed as necessary.	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant Equipment's Budget including to EPC contract cost
Terretrial ecosystem and rare spccies	Air pollution and noise/vibration resulting from power generation will cause negative effect to terrestrial	- The alteration of the site should be requisite minimum. - Introduction of low NOx combustion appliances - Use of high stack	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
	organisms	- Use low-noise equipment - Use of GT enclosure, GT intake silencer, turbine building, pomp building - Use of low-vibration equipment - Construction of buildings with strong foundation - Regular maintenance of the equipment - Bird hunting by workers shall be prohibited. - The plant site is vegetated with plants living in the surrounding coast or plant species resistant to salt damage/			
Marine ecosystems and rare species	-Taking in organisms by cooling water intake, pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of Thermal water are expected to have impact on marine organisms.	- Cooling water shall be taken at the low rate of 0.2m/s to minimize intake of fish and other marine organisms. - In order to minimize the area of water temperature rise, cooling water shall be taken from 1.3km from the coast and a lower water layer 6m deep where water temperature is low, and be discharged at the high rate of 2.5m/s from the coast near the project site. - Installation of water treatment facility - Drain system will be introduced to gather oily rain water - Monitoring of sea grass in the shallow water area surround outlet. - If sea grass will widely disappear by thermal water, creation of see grass bed will be conducted for fishes and benthos with cooperation of MENR.	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant
Marine hydrology	-Because Cooling water will be intake and discharged, there will be changes in flow conditions in the vicinities of the discharged.	- Water temperature rise due to condenser shall be maintained Δ9°C to minimize the amount of cooling water. - Water shall be taken at the low rate of 0.2m/s.	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
Local economy including employment and means of livelihood	- Local people may be employed as workers by the power plant. It may purchase materials and equipment items in the local area. - If employing local people and/or outsourcing contracts are not fair, benefit may be unfairly distributed.	- Employment of local residents as many as possible. - Use of the services (i.e. laundry and catering service etc.) and products offered in the local community, as possible - Provision of job training for employment, if need - The employment of the local people shall be conducted under publicized employment conditions.	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant
Water use	- Installation of water taking and discharging facilities may have impact on navigation of small boats for a recreational purpose. - Taking organisms by cooling water intake, pollutants discharged from plant waste water and oil-containing waste water, and rises in the temperature of thermal water may cause impact on the recreational fishing.	- The location of offshore water intake equipment shall be marked with a buoy installed around the equipment. - Cooling water shall be taken from the lower water layer 6m deep at the low rate of 0.2m/s to minimize intake of fish and other marine organisms, and to avoid adverse impact on the operation of fishery vessels. - In order to minimize the area of water temperature rise, cooling water shall be taken from 1.3km from the coast and a lower water layer 6m deep where water temperature is low, and be discharged at the high rate of 2.5m/s from the coast near the project site. - Installation of water treatment facility - Drain system will be introduced to gather oily rain water - Monitoring of wastewater and sea water compared to the standard of Azerbaijan and IFC/WB EHS Guidelines	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant
Existing social infrastructure and social service	-Lodging houses, medical treatment facilities, sewer systems and other	- Employee's houses shall be prepared in the site. - Properly control maintenance schedule and processes.	Continuously	Implementation; EPC Contractor, Environmental	Expense is included in EPC contract cost by EPC Contractor.

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
	infrastructure may be needed for workers.	- Determine the traffic control plan including route-setting in maintenance - Training safe operation of vehicles.		consultant Supervisor-consultant, PIU	
Labor environment	- Workers may have accidents during service. - Security guards may infringe on the security of surrounding people.	- Compliance of safety regulations and laws - Development of a safety and sanitation management plan - Establish a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Keep them well maintained and perform maintenance checks as appropriate during the period of operation.	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant
Accident	-Fire and Traffic accident by operation of facilities and/or vehicles.	- Development of gas-leakage prevention management plan - Gas-leakage alarm system - Installation of stationary fire prevention system, fire hydrant, fire extinguisher, fire escape exit, fire alarm, fireproof compartment, emergency exit, etc. - Installation of automatic control system - Construction of fire-fighting facility - Inspection of equipment - During the land transportation at the periodic inspection, the existing highways and other roads shall be basically used. - In case of using the roads in the residential area for periodic inspection, traffic of construction vehicles during school commuting hours shall be avoided -Checking of traffic regulations, installation of traffic signs, driving safety education, speed restriction, checkup of vehicle equipment (brake,	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant

Items	Potential impact	Mitigation measures	Implementation	Responsible organization	Budget
		horn)			
Global warming	CO_2 emission caused global warming is generated by operation of Yashma CCPP	- Adoption of high-efficiency combined cycle power generation system and maintenance of capacity of the facility	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant

13.8 Environmental Monitoring Plan

The details of the environmental monitoring plan for Power plant during construction and operation phase are shown in Table 13.8-1.

Environmental monitoring implementation structure with the reporting flow is shown in Figure 13.7-1 and Figure 13.7-2 (Previous chapter).

In addition, the project proponent should discuss about environmental monitoring plan with JICA in JICA's appraisal mission.

If monitoring results of air quality, noise and water quality will be confirmed to exceed of Azerbaijan and IFC/WB standards by the construction and operation of power station, additional mitigation measures should be conducted.

Table 13.8-1 Items, Location, Method, Frequency, Responsibility and Expense of the Environmental Monitoring Plan

No.	Item		Method	Location	Frequency	Responsibility	Budget
Construction phase							
1	Air quality	SO_2,NOx (NO, NO_2.), Suspended particles (Dust)	Ambient air quality analyzers	The residential area in the south of the site.	Once a week at the maximum construction activity.	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
2	Waste water	pH, SS, oil and grease	Sample analysis	Outlet of waste treatment facility	Every week	Yashma Power Plant	Azerenerji/ Yashma Power Plant
3	Sea water quality	pH, SS, oil and grease	Sample analysis	At the dredging site and the front sea area of the site.	At the dredging activity and drilling and filling.	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
3	Waste	Waste management practice in storage and disposal	Contract and record	Project site and associated facilities	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
4	Noise	Noise level	Sound-level meter	Site boundary and the residential area in the south of the site.	Once a week at the maximum construction activity with interval of 1hr for 24hr of 1 day.	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.

5	Ecosystem (Sea grass) (Caspian seal)	Species, Weight ,habitat area	-Collecting samples at the site, analyzing at a lab -Observation -Observation	Shallow water area within 2km from outlet -Surrounding of Intake tower and facing of the site	Period of dredging work. -Same as above	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
6	Labor and working conditions	Conformity of laws and regulations	Inspection	Project site	Continuously	Implementation; EPC Contractor, Environmental consultant Supervisor-consultant, PIU	Expense is included in EPC contract cost by EPC Contractor.
7	Grievances	Numbers, contents, and processing results of grievances	Recording	-	Continuously	Supervisor-consultant, PIU	PIU
No.	Item		Method	Location	Frequency	Responsibility	Budget
Operation phase							
1	Air quality	NOx (NO_2, NO)	Ambient air quality analyzers	Residential area	3 years from the start of the operation. Quarterly, Once a week	Yashma Power Plant	Azerenerji/ Yashma Power Plant
2	Exhaust gas	NOx	Continuous Emission Monitoring System(CEMS)	Gas duct	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant CFMS’s Budget including to EPC contract cost

3	Waste water	<Thermal water> -Temperature, Salinity, Residual chlorine < Plant Waste water> - pH, DO, COD, SS, Oil and grease, Phenol, Ammonia, Nitrite, Nitrate, Sulfate, ride, Ca, Na, K, Phosphate, As, Cd, Cu, Fe, Pb, Hg, , Zn, Cr < Domestic wastewater> -Temperature, pH, SS, COD, Oil & Grease, Total nitrogen, Total phosphorus, Total coliform bacteria	Automatic measuring equipment Sample analysis	-Outlet of the condenser -Outlet of waste treatment facility -Outlet of waste treatment facility	- Continuously - Every month - Every month	Yashma Power Plant	Azerenerji/ Yashma Power Plant Automatic measuring equipment 's Budget including to EPC contract cost
4	Sea water quality	- Temperature, Salinity, pH, DO, COD, SS, Oil and grease, Phenol, Ammonia, Nitrite, Nitrate, Phosphate, As, Cd, Cu, Fe, Pb, Mn, Hg, Ni, Zn, Co, Al	Sample analysis	Within 500m from outlet	3 years from the start of the operation. Quarterly	Yashma Power Plant	Azerenerji/ Yashma Power Plant
5	Waste	Waste oil, sludge, domestic waste	Contract and record	Project site and associated facilities	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant
6	Noise	Noise level	Sound-level meter	Site boundary and the residential area in the south of the site.	Quarterly a year with interval of 1hr for 24hr of 1day.	Yashma Power Plant	Azerenerji/ Yashma Power Plant
7	Ecosystem (Sea grass) (Caspian seal)	Species, Weight ,habitat area	-Collecting samples at the site, analyzing at a lab -Visual Observation by plant staff	Shallow water area within 2km from outlet -Surrounding of Intake tower and facing of the site	3 years from the start of the operation. Spring and summer -Same as above	Yashma Power Plant	Azerenerji/ Yashma Power Plant

8	Labor and working conditions	Conformity of laws and regulations and laws	Inspection	Project site and associated facilities	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant
9	Grievances	Numbers, contents, and processing results of grievances	Recording	-	Continuously	Yashma Power Plant	Azerenerji/ Yashma Power Plant

13.9 Stakeholder Meeting and Others

13.9.1 1st Stakeholder Meeting

(1) Date and time

11th of Aril 2014, from 15:00 PM

(2) Place

Azerbaijan, Sumgait city, Sumgait Power Plant, Conference room

(3) Purpose of the meeting

_The role and objectives of the JICA and JICA study team

_Information on the impact on the environment and impact on socio-economic

(4) Participants

There were 46 participants including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders.

(5) Language

Azerbaijani

Participant list:

No.	Ad, Soyad/Name, Surname	Təmsil etdiyiniz qurum/təşkilat və peşəniz/ Organisation/Company and profession
1		Sumgayit PP, Director
2		- (no inscription)
3		- (no inscription)
4		Lawyer
5		Azerboru , engineer
6		Jorat district, engineer
7		Nasosni district, H.Z. Tagiyev h.23, enginner

No.	Ad, Soyad/Name, Surname	Təmsil etdiyiniz qurum/təşkilat və peşəniz/ Organisation/Company and profession
8		- (no inscription)
9		- (no inscription)
10		- (no inscription)
11		SOCAR engineer
12		Sumgayit city resident
13		Technician
14		- (no inscription)
15		Sumgayit PP, accountant
16		Accountant
17		Engineer
18		- (no inscription)
19		- (no inscription)
20		Kimyachilar district, housekeeper
21		- (no inscription)
22		- (no inscription)
23		- (no inscription)
24		- (no inscription)
25		- (no inscription)
26		- (no inscription)
27		- (no inscription)
28		Resident of Sumgayit city, engineer-mechanic
29		- (no inscription)
30		- (no inscription)
31		- (no inscription)
32		Technician

No.	Ad, Soyad/Name, Surname	Təmsil etdiyiniz qurum/təşkilat və peşəniz/ Organisation/Company and profession
33		Azerkimya, engineer electrician
34		H.Z. Tagiyev district h.4, 90
35		Sumgayit city, 10mk, h.21, 141
36		SOCAR technician
37		- (no inscription)
38		- (no inscription)
39		- (no inscription)
40		- (no inscription)
41		Jorat district, assistant
42		- (no inscription)
43		Resident of Sumgayit city 41a
44		- (no inscription)
45		- (no inscription)
46		- (no inscription)

(6) Summary of the meeting

1. Opening remarks, the project description
2. Presentation of the project
3. Questions and answers.

Main speech, questions and answers are the following;

Speakers;	Contents;
Director of Sumgait Power Plant	Opening of public meeting and welcoming guests. Presentation of participants. Determination of discussion topics and order of discussions. Informing participants about the importance of planned Yashma Combined Cycle Gas Turbine Power Plant Construction Project in context of dynamic economic development of Azerbaijan, realizing

	state programs in energy sector signed by President of Azerbaijan.
Team Leader of JICA study team	Opening remarks.
JİCA Study Team member for Yashma project	Informing about Guidelines for Environmental and Social Considerations Environmental and Social Consideration of Japan International Cooperation Agency (JICA) (hereinafter, JICA guidelines), goal and duration of JICA project in Yashma, effectiveness of ecological friendly technologies of new Power Plant, Gas Pipeline and Transmission Line. Currently planned capacity of power plant is 900-950 MW. The plant will consist of two blocks and use natural gas as a fuel. According to the result of initial research the technologies which will be used in construction work will not greatly impact on the environment. The water which will be used at plant will be taken from Caspian Sea. Water is taken from the depths of the sea for cooling system. JICA needs to confirm the project satisfy the conditions of Azerbaijan and JICA concerning environmental and social impacts. JICA is interested to know about environment impacts and results of impacts to the environment. The final report will be provided to Ministry of Nature Resources of Azerbaijan and after approval it will be uploaded to JICA website for public disclosure. The presentation includes initial research materials on project description of power plant, transmission lines and substations, gas pipeline map, collected data by local consultants on marine environment, atmosphere, noise and vibration, fauna and flora, study of data on species listed in Azerbaijani Red book and IUCN listed species, Social Environment: land use, land traffic, sanitation, population & demography, education, public infrastructure, employment, income and expenditure, tourist site, cultural and heritage properties, minorities. In order to identify environmental impacts, the past database must be reviewed and field

	research will be conducted. Different modeling results will be prepared and presented to community in the next stakeholder meeting. After the first public meeting, field researches will start. Air quality research as well as noise measurement will be conducted throughout 24 hours in 2 places – Power Plant area and in nearest living area. JICA study team will prepare EİA report based on the data collection work and field survey.
Question 1 from the local participants	“ Could you tell about wastes, pollutions during construction activities? May I know about level of emissions?”
Answer 1 from JICA study team	“As the Power Plant will use natural gas as a fuel CO, CO_2, NOx etc. Emissions are expected. All local and international standards will be met.”
Question 2 from the local participants	“We wish you success and welcome to project staff. This is third project in Sumgayit which we know. Is that possible to use sea water in cooling system effectively and protect sea from negative impacts?”
Answer 2 from JICA study team	“Intake water system is the same as in Shimal Power Plant and the water which will be taken from the depth of the sea will be discharged back to the sea without any negative impact. We will notify you about the results of the research in the second stakeholder meeting.
Question 3 from the local participants	“Do you intend to plant trees around the new station ? ”
Answer 3 from JICA study team	“There is a plan to install tree-planting area in the project site. The tree-planting area was installed at various existing power plants. “
Question 4 from the local participants	“Is there such large-scale of the same type plant in other countries?”
Answer 4 from JICA study team	“ Currently, Indonesia and Malaysia build bigger and stronger plants . Malaysia built in two blocks of 700 MW.”
Question 5 from the local participants	“How to handle the cooling system of the power plant in operation? Where is the water which will be taken from? ”
Answer 5 from JICA	“The cooling system water will be taken from the depth of

study team	the sea. After the process of mineralization and other treatment we will use it in cooling system. ”
Question 6 from the local participants	“Are you plan to conduct monitoring of emissions to the environment? ”
Answer 6 from JICA study team	“Yes. Both water and air.”

NB: There was no opinion or remark explaining the protestation against the project.


Figure 13.9-1 Pictures Taken during the First Stakeholder Meeting

13.9.2 2nd Stakeholder Meeting

(1) Date and time

4th of July 2014, from 12:00 AM

(2) Place

Azerbaijan, Sumgait city, Sumgait Power Plant, Conference room

(3) Purpose of the meeting

_Present the result of environmental impact assessment study

_Present management plan and monitoring plan

Question and answer about the result and plans

(4) Participants

There were 51 participants including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders.

(5) Language

Azerbaijani

Participant list:

№	Ad, Soyad/Name, Surname	Təmsil etdiyiniz qurum/təşkilat və peşəniz/ Organisation/Company and profession
1		Resident of Sumgayit city, engineer
2		Resident of Sumgayit city, housekeeper
3		Jorat district, assistant
4		Kimyachilar district, housekeeper
5		Resident of Sumgayit city, engineer-mechanic
6		Resident of Sumgayit city, engineer-mechanic
7		Resident of Sumgayit city, 8mk,h.10
8		Resident of Sumgayit city Kimyachilar district
9		Resident of Sumgayit city 41a
10		Azerenerji JSC
11		Investment Department , Azerenerji JSC
12		Investment Department, Azerenerji
13		Investment Department, Azerenerji
14		Azerenerji JSC, head of press center
15		Academy of Science, EcoNote
16		Lawyer
17		Engineer
18		Worker
19		Azerkimya , engineer electrician
20		Azerboru , engineer
21		SOCAR technician
22		Sumgayit PP, specilaist
23		H.Z. Tagiyev district, Sattar Bahl street
24		Sumgayit PP, accountant
25		Sumgayit city resident
26		Sumgayit city resident
27		Sumgayit city, engineer
28		Sumgayit city resident, engineer

№	Ad, Soyad/Name, Surname	Təmsil etdiyiniz qurum/təşkilat və peşəniz/ Organisation/Company and profession
29		Sumgayit city resident, gardener
30		Sumgayit city resident, gardener
31		Sumgayit PP, engineer
32		Rigger
33		Commodities expert
34		SOCAR engineer
35		Economist
36		Technician
37		Accountant
38		Painter
39		Assistant
40		Assistant
41		Technician
42		Jorat district, engineer
43		Nasosni district, H.Z. Tagiyev h.23, enginner
44		Sumgayit city, mk.3, 18/33, 9, doctor
45		H.Z. Tagiyev district h.4, 90
46		Sumgayit city, 10mk, h.21, 141
47		EcoNote, social specialist
48		"Azerbaijan Lights" newspaper
49		Sumgayit PP,Director
50		Sumgayit PP, BMM
51		Azerenerji JSC, Ekologist

(6) Summary of the meeting

1. Opening remarks, the project description
2. Presentation of the project
3. Speech by Governor of district
4. Questions and answers.
5. Conclusion

Main speech, questions and answers are the following;

Speakers;	Contents;
Director of Sumgait Power Plant	Opening of the public meeting and welcoming guests. Presenting the participants. Introducing the discussion topics and their sequence. Informing participants about the purpose of the Second Public Meeting on the planned Yashma Combined Cycle Gas Turbine Power Plant Construction Project.
JİCA Study Team member for Yashma project	Presentation on Environmental Impact Assessments of Yashma Power Plant Project. Explanation about Guidelines for Environmental and Social Considerations of Japan International Cooperation Agency (JICA), goal and duration of the JICA project in Yashma, effectiveness of ecological friendly technologies of the new Thermal Power Plant, Gas Pipeline and Transmission Line. The current planned capacity of the power plant is 900-950 megawatts. The station will consist of two blocks. The natural gas will be used as a fuel. The technologies which will be used in the construction work won’t cause any negative impacts on the environment. The water to be used for the cooling system at the plant will be taken from depth of the Caspian Sea. JICA explained the requirements to fulfill the conditions of Azerbaijan and JICA concerning environmental and social impacts. JICA is interested to identify and recognize the environment impacts. The project’s energy efficient technologies, water treatment

	systems, quality of air, noise, temperature of water were explained. The project will be realized in the manner that will meet all ecological standards and protect the nature from negative impacts. The works will be conducted mainly during the daytime for protection of the local population from noise in the evening and night time. The local people will be employed in the temporary works.
Biodiversity Specialist of the project	He mentioned in his presentation about 19 plant species in the power plant area, 24 species in the transmission lines area and 30 species on the gas pipeline route. According to his information, there are no species, birds or fishes included in IUCN Red Book or the Red Book of Azerbaijan found in the territory of power plant, transmission line or gas pipelines. Only two species, Mediterranean tortoise and Red Falcon bird were mentioned as vulnerable in the Red Book of Azerbaijan.
Question 1 from the local participants	“We are concerned about dust and noise caused during the construction activities. How often monitoring will be conducted during the construction period? Do you consider providing online monitoring?”
Answer 1 from JICA study team	“We plan to conducted monitoring in the period of maximum construction activity. Contractors will conduct monitoring in selected period by online or other systematic monitoring equipment.”
Question 2 from the local participants	“How do you monitor the change of water temperature in the Caspian sea ?”
Answer 2 from JICA study team	“We will install equipment to measure water temperature of thermal effluent. Water temperature will be measured around the site as well.”
Question 3 from the local participants	“Do you have a special device for cooling the generator?”
Answer 3 from JICA study team	“Yes. We have all modern devices for proper use of the generator.”
Question 4 from the local participants	“What kind of green activities are planned near the power station?”

Answer 4 from JICA study team	"On the south side of the Power Station many trees will be planted and other environment protection activities will be conducted."
Conclusion	Specialists from Sumgayit Power Station, community member from Jorat settlement, community members from Z.Tagiyev settlement were satisfied with the answers on their questions. Representatives from Sumgayit, Zeynallabdin Taghiyev settlement, settlement of Nasosniy, Jorat settlement of Sumgayit, as well as from Sumgayit Power Plant, Azerkimya, Azerboru, SOCAR companies, also teachers, journalists from newspaper "Azerbaijan ishiqlari", housekeepers from Z.Tagiyev settlement were glad to meet with representatives from JICA Study Team.

Figure 13.9-2 Pictures Taken during the Second Stakeholder Meeting

13.10 Brief Resettlement Action Plan

13.10.1 Analysis of the Legal Framework concerning Land Acquisition and Resettlement

According to "Resettlement policy framework Azerbaijan, ministry of justice" (June 2012), Azerbaijan legislation has the following norms, which provide instruction on matters relating to land, land acquisition and compensation for other property losses:

- The Land Code (25 June 1999);
- The Civil Code (01 December 1998);
- Law on Acquisition of Lands for States Needs (20 April 2010);
- Law on Land Market (07 May 1999);
- Law on Land Reform (16 July 1996);
- Presidential Decree (10 January 1997, N534) on Rules about Selling and Buying the Lands;
- Presidential Decree (15 March 2002, N274) on Charter about Rules on Drafting and Approving of the Documents Relating to the Allocation of Municipalities` Lands;
- Presidential Decree (23 October 2003, N972) on Additional Steps Relating to Implementation of Law "On Land Rent" and Approving the Rules about the Auctions Relating to the Allocation of Lands to the Ownership or Renting;
- Cabinet of Ministers Resolution N158 (1998) on Establishment of New Normative Prices for Land in the Republic of Azerbaijan;
- Cabinet of Ministers Resolution N110 (1999) on Approval of Regulations for an Inventory Cost Estimation of Buildings Owned by Natural Persons;
- Cabinet of Ministers Resolution N42 (2000) on Some Normative and Legal Acts Relating to the Land Code of the Republic of Azerbaijan;

Table 13.10-1 Gaps between the Laws of Azerbaijan and JICA Guidelines

No.	JICA Guidelines	Laws of Azerbaijan	Gap between JICA Guidelines and Laws of Azerbaijan	Correspondence of the Project
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	The Land Code and Law on Acquisition of Lands for States Needs, stipulate that lands can be withdrawn only for location of state, municipal, or public	Azerbaijan law allows that lands can be withdrawn for location of state, municipal, or public facilities of high important without by	The project site was selected so as to avoid physical displacement

No.	JICA Guidelines	Laws of Azerbaijan	Gap between JICA Guidelines and Laws of Azerbaijan	Correspondence of the Project
		facilities of high importance. Cabinet of Ministers Resolution N42 requires the need to avoid, wherever possible, impacts on agricultural land and forests	exploring all viable alternative	
2.	When population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.	The Civil Code states that any rights to immovable properties must be registered with the state, and that land may be recalled from owners for state or municipal needs as approved by the relevant courts. And, the law on Acquisition of Lands for States Needs provides the detail procedure of acquiring the lands for state needs, calculating the amount of compensation, the rules of paying this compensation as well as stipulates the other relations between the parties relating the land acquisition.	There is no gap.	The project was selected so as to avoid physical displacement
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standards of living, income opportunities and production levels to pre-project levels.		There are no specific references in the legislation to “involuntary resettlement.”	Compensation will enable affected households to restore their pre-project incomes and standard of living following the implementation of the LARAP
4.	Compensation must be based on the full replacement cost as much as possible.	The need to compensate based on full market value or through grant of another land plot or building of equal quality, size, and value (Land Code)	The compensation in Azerbaijan is based on market value although JICA guideline include replacement cost	Affected households are entitled to be compensated at full replacement cost (excluding depreciation) for their lost assets, including temporary losses or impacts.
5.	Compensation and other kinds of assistance must be provided prior to displacement.	Compensation will be paid prior to construction of works.	There is no gap.	Compensation will be fully provided before land can be acquired for civil works or demolition.
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made	Resettlement Action Plan (RAP) should be prepared in accordance	There is no gap.	The project site was selected so as to avoid physical displacement.

No.	JICA Guidelines	Laws of Azerbaijan	Gap between JICA Guidelines and Laws of Azerbaijan	Correspondence of the Project
	available to the public.	with the laws and regulations on land acquisition and resettlement in Azerbaijan		
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	The details of land acquisition procedure will be spelled out in RAP(s) including - Initial consultation with PAP (Project-Affected Person) to notify the project and board impact; However currently there is no explicit consultation requirement in Azerbaijan legislation.	Currently there is no explicit consultation requirement in Azerbaijan legislation, but only recommended	Affected households will be consulted with in course of the preparation and implementation of the LARAP.
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.	All official documents and communication should be done in Azeri language in Azerbaijan.	There is no gap	All official documents and communication will be done in Azeri language
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.	RAP includes a census, socioeconomic survey, consultation with project affected people, monitoring, or reporting.	The census is done to identify all affected people, however there is no specification on the information to be provided	Affected households will consulted with in the course of the preparation and implementation of the LARAP if the case occurs
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	If landowners are unhappy with the valuation, there is scope for agreeing on a revised valuation. In the event that such agreement cannot be reached, the acquiring authority can process its application for acquisition through the courts. (Land Code)	There is no gap	Grievance redress mechanism will be established.
11.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an	RAP includes a census, socioeconomic survey, consultation with project affected people, monitoring, or reporting.	There is no gap	A census is and will be conducted for the project site

No.	JICA Guidelines	Laws of Azerbaijan	Gap between JICA Guidelines and Laws of Azerbaijan	Correspondence of the Project
	initial baseline survey (including a population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	The list of PAP will be considered the final census and the day it is signed will be the 'cut-off' date		
12.	Eligibility of benefits include the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who do not have formal legal rights to land at the time of census but have a claim to such land or assets, and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	Land code describe willful occupation of land plots and implementation of illegal construction on land plots as violations of the land legislation, and state that these are prohibited acts	The PAP occupying illegally the concerned land will not be included to the compensated persons. However if should the case arise then non-formal users can be considered in RAP preparation and compensation.	All affected households will be received compensation regardless of the legal status of the land and land use rights.
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	The need to compensate based on full market value or through grant of another land plot or building of equal quality, size, and value Special compensation is planned for all those people, who might lose income because of loss of land or annual crops or perennial crops/plants loss because of resettlement. Should loss of income occur because of loss of	There is no preference between cash compensation and land-based resettlement strategies in Azeri legislation	Provision of equivalent land will be the preferred compensation for lost land, unless the affected household chooses cash compensation. In the reality, to find a new fertile land in Azerbaijan is difficult. Therefore, cash compensation is often preferred for agricultural land compensation

No.	JICA Guidelines	Laws of Azerbaijan	Gap between JICA Guidelines and Laws of Azerbaijan	Correspondence of the Project
		annual crops or perennial crops/plants (Civil Code)		
14.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	Households that lose a significant proportion of their total land holding (more than 50 percent), such that it is no longer economically viable to cultivate, will receive rehabilitation assistance such as access to employment or training facilities for employment and so forth, in addition to compensation for lost assets. No business closure is expected under the project.(Civil Code)	The compensation during transition period exists in Azerbaijan with restriction (proportion of affected land holding more than 50%)	This project is not concerned. For associate facilities such as transmission line or gas pipeline, if those facilities are planned to be installed in private land, the compensation during transition period will be considered even if the affected land proportion is below 50%.
15.	Particular attention must be paid to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, elderly, women and children, and ethnic minorities, etc. (WB OP4.12 Para.8)	There is no explicit measure to vulnerable groups, however, Azeri government published a policy to define Vulnerable Peoples Allowance (VPA) as below: Vulnerable people (PAPs below poverty line and women or elder headed households without any other bread-winner member of family) will be given an allowance corresponding to 3 months of minimum subsistence income and priority in employment in project-related jobs. The allowance is to be calculated based on a 5 people family and the monthly-updated benchmarks indicated by the State Statistical Committee of Azerbaijan at time of RAP approval (Resettlement Policy Framework, Ministry	There is no explicit measure for VPA, but Azeri government published a policy to consider those people. VPA doesn't include elderly, children, ethnic minorities	Compensation will be provided giving equal consideration to women and men, and other VPA including elderly, children, ethnic minorities In addition it is reported that there is no minorities around the project site

No.	JICA Guidelines	Laws of Azerbaijan	Gap between JICA Guidelines and Laws of Azerbaijan	Correspondence of the Project
		of Justice)		
16.	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, an abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	There is no limitation of number of affected people for the elaboration of RAP	There is no condition of the number of affected people to make LARAP	The project site was selected so as to avoid physical displacement. For associate facilities such as transmission line or gas pipeline, if those facilities are planned to be installed in private land, LARAP will be elaborated.

Source: Study Team

13.10.2 Necessity of Land Acquisition and Resettlement

In this particular project, the land is acquired directly from government as the Yashma site is totally government owned land.

The process is on-going between government and project proponent. The promulgation by the government to allow the use of the land will be done once those processes will be closed.

Therefore no Land Acquisition and Resettlement Action Plan is required for this particular project.

The case of PAPs who do not have formal legal rights to land at the time of census is the only case which can be considered for this project. However the project proponent considers that there is no such land use for the concerned land.

Concerning the transmission line, substation and gas pipeline, current installation plan is not required to acquire private owned land (based on the social survey for the installation of transmission line).

Therefore no Land Acquisition and Resettlement Action Plan is required for these projects.

13.11 Other

13.11.1 Environmental Checklist of Power Plant

Table 13.11-1 shows the result of environmental and social consideration reviewed according to the checklist attached to JICA Guideline.

Table 13.11-1 Check List of Power Plant (Yashma CCGP)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) N (d) N	(a) The EIA preparation is on the process in an official way. (b) The EIA report will be submitted in August 2014to the Ministry of Ecology and Natural Resources (MENR) which is responsible for the EIA process in Azerbaijan under Article 42 of 1999 Law of the Azerbaijan Republic on Protection of the Environment. (c) The EIA has not been approved yet. (d) The ecological passport described of the expected volume of air and water discharges, the quantity of expected water use, the expected amount of solid waste generated, etc. should be prepared by and applicant and submitted to MENR prior to the commercial operation. MENR will review this passport and approve the commercial operation of the project facility. (Reference: Draft Final p.13-33)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
1 Permits and Explanation	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is the understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) The first Public Consultation was held in Sumgait city on 11 April 2014 in order to give and explanation of the project overview and its environmental and social impacts to the local residents. 46 people attended, including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders. Any negative comments to the project were not obtained. The second public consultation was held in Sumgait city on 4 July 2014. in order to give and explanation of the project overview and its environmental and social impacts to the local residents. 51people attended, including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders. (Reference: Chapter 9.3 Public Consultation) (b) The comments will be adequately reflected in the project through environmental management plan.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) The alternatives were discussed regarding zero-option, site selection, fuel selection, power generation method and cooling system. (Reference: Chapter 7 Analysis of alternatives)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
2 Pollution Control	(1) Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted by the power plant operations comply with the country's emission standards? Is there a possibility that air pollutants emitted from the project will cause areas that do not comply with the country's ambient air quality standards? Are any mitigating measures taken? (b) In the case of coal-fired power plants, is there a possibility that fugitive dust from the coal piles, coal handling facilities, and dust from the coal ash disposal sites will cause air pollution? Are adequate measures taken to prevent the air pollution?	(a) Y (b) N/A	(a) Since natural gases will be used as fuels, sulfur oxides and dust (PM: particle matters) will not be generated. The NOx concentration in the gas emission will comply with the standard of the IFC/WB EHS guidelines. Atmospheric diffusion simulation of NOx emitted from the plant was conducted, and the result indicated that NOx concentration satisfies IFC/WB EHS Guidelines, environmental standard values of the EU, and Japanese ambient air quality standard values. The project proponent will take the following action to mitigate air quality concerns - Use of natural gas - Introduction of Low-NOx Burner - Use of high stack - Monitoring of exhaust gas and ambient air in the residential area (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact Chapter 8 Environmental Management Plan and Monitoring Plan) (b) The project is not a coal-fired power plant.
	(2) Water Quality	(a) Do effluents including thermal effluents from the power plant comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards or cause any significant temperature rise in the receiving waters? (b) In the case of coal-fired power plants, do leachates from the coal piles and the coal ash disposal sites comply with the country's effluent standards? (c) Are adequate measures taken to prevent contamination of surface water, soil, groundwater, and seawater by the effluents?	(a) Y (b) N/A (c) Y	(a) ＜Thermal water ＞ Thermal water will be discharged to the sea. According to a diffusion calculation of thermal effluents from the power plant, a five-degree rise of surface water temperature ranges within 180m from the water outlet in the case of southwest current at 0.3m/s and ranges within 350m in the case of no winds, which satisfy Azerbaijan standard. The appropriate amount of chlorine will be added into cooling water to prevent shellfish from adhering to pipes, so that residual chlorine concentration in thermal effluent will be below the IFC/WB Guidelines (0.2mg/L). ＜Plant wastewater, oil-containing wastewater, and domestic wastewater＞

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
				Wastewater from raw water treatment plant (desalination plant) and regeneration waste water from demineralization plant, blow water from HRSG, oily drainage wastewater surrounding tank of lubricant and domestic sewage will be collected at the wastewater treatment system. The wastewater treatment system will consist of neutralization, coagulating sedimentation, filtration, oil separator and aeration. Monitoring of thermal water ,wastewater and sea water compared to the standard of Azerbaijan and IFC/WB EHS Guidelines (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact) (b) The project is not a coal-fired power plant. (c) Project proponent will take the following action to mitigate water quality concerns. - Installation of water treatment facility - Drain system will be introduced to gather oily rain water - Monitoring of thermal water ,wastewater and sea water
2 Pollution Control	(3) Wastes	(a) Are wastes, (such as waste oils, and waste chemical agents), coal ash, and by-product gypsum from flue gas desulfurization generated by the power plant operations properly treated and disposed of in accordance with the country’s regulations?	(a) Y	(a) General waste and hazardous waste including waste oil, sludge, sewage, and garbage will be generated. Separating waste collection, recycling and reuse of waste will be promoted and non-recyclable waste will be disposed at appropriate sites according to the related regulations. Hazardous waste will be treated under the related regulations. Project proponent will take the following action to mitigate waste concerns - Prohibition of illegal dumping - Return waste oil to the suppliers to treat it appropriately - Separation of waste by hazard level, storage in an appropriate sites and legal disposal in an appropriate disposal site - The record of the generation amount of waste and the disposal site. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact Chapter 8 Environmental Management Plan and Monitoring Plan)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
2 Pollution Control	(4) Noise and Vibration	(a) Do noise and vibrations comply with the country's standards?	(a) Y	(a) The predicted noise level is approximately 34-48 dB(A) at the boundary of the power plant site and 38-45dB(A) at the residence. These figures meet the day-time and night-time noise level standard of Azerbaijan and IFC/WB guideline. The predicted vibration level is approximately 0-25 dB at the boundary of the power plant site and 6-19dB at the residence. The vibration levels at all points are below the minimum measured level of vibration (25dB). The further mitigation measures will be taken such as regular maintenance of equipment and introduction of low noise and vibration type equipment. The south of the site near the employees' house and the site boundary is vegetated with plants living in the surrounding coast or plant species resistant to salt damage. Monitoring of Noise level at site boundary and the residential area compared to the standards of Azerbaijan and IFC/WB EHS Guidelines Furthermore, sound insulating walls will be installed as necessary. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact Chapter 8 Environmental Management Plan and Monitoring Plan)
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N/A	(a) Potable water consumed at the plant does not use groundwater.
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) Y	(a) Domestic waster will be generated. However, domestic waste will be disposed/reused on a periodic basis to ensure that odor by putrefaction is not produced. In addition, workers will be instructed to classify and collect garbage and not dispose waste illegally.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) No protected areas and national parks are within the site. The nearest national park, the Altiaghaj national park, is located about 40km away from the power plant site to the north-west. (Reference: Chapter 4.1 Protected Area and Park)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b)N (c) Y (d) N/A (e) N	(a) Most of the area around the power plant is semi-desert area. The area is so dry and most part of soil is salty. No primeval forests, tropical rain forests, coral reefs, mangroves, tidal flats around the site (Reference: Chapter 4 Existing Environment: Ecological) (b) According to the site survey result, flora and fauna covered by the Azerbaijan Red List are not observed. Additionally, this survey does not find any precious species which are targeted by CITES and which are categorized into 'Endangered', 'Vulnerable' and 'Near Threatened'. (Reference: Chapter 4 Existing Environment: Ecological) (c) The impacts of the operation on ecosystems are expected but limited. Additionally mitigation measures as follows: - Mitigation measures for air pollution, noise and vibration will be adequately implemented to reduce the impact on flora/fauna. - Bird hunting by workers shall be prohibited. -The plant site is vegetated with plants living in the surrounding coast or plant species resistant to salt damage. (d) Water will not be drawn up from underground. Therefore, no impacts are expected. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	(2) Ecosystem	(e) Is there a possibility that discharge of thermal effluents, intake of a large volume of cooling water or discharge of leachates will adversely affect the ecosystem of surrounding water areas?		(e) Taking in organisms by cooling water intake, pollutants discharged from plant waste water, and rises in the temperature of thermal water are expected to have impact on marine organisms. The result thermal effluent diffusion satisfies the standard of Azerbaijan and the project proponent will take measures to mitigate the impacts of intake and discharge water such as; - Cooling water shall be taken at the low rate of 0.2m/s to minimize intake of fish and other marine organisms - Water intake/discharge method shall be selected to minimize the area of water temperature rise - Water temperature rise due to condenser shall be maintained Δ9°C to minimize the amount of cooling water. - Water pollution mitigation measures shall be conducted - Monitoring of sea grass in the shallow water area surround outlet. - If sea grass will widely disappear by thermal water, creation of see grass bed will be conducted for fishes and benthos with cooperation of MENR. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact Chapter 8 Environmental Management Plan and Monitoring Plan)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a)N (b)N/A (c)N/A (d)N/A (e)N/A (f)N/A (g)N/A (h)N/A (i)N/A (j)N/A	(a) The project site is governmental land and not been privately used for farm land and residential area, etc. Therefore, involuntary resettlement is not expected by the project. (Reference: Chapter 5.2 Land Use) (b)～(j) -

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is sufficient infrastructure (e.g., hospitals, schools, and roads) available for the project implementation? If the existing infrastructure is insufficient, are any plans developed to construct new infrastructure or improve the existing infrastructure? (c) Is there a possibility that large vehicles traffic for transportation of materials, such as raw materials and products will have impacts on traffic in the surrounding areas, impede the movement of inhabitants, and any cause risks to pedestrians? (d) Is there a possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?	(a) N (b) Y (c) Y (d) Y	(a) Since the site is governmental land and not been used for farmland and residential area, the project will have no impacts. Instead, the project will bring benefit to local people including increase of local employment and more opportunities to offer local services and products. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact) (b) Lodging houses, medical treatment facilities, sewer systems and other infrastructure may be needed for workers. The housing for the workers shall be organized within the site. In the period of regular maintenance in which a large number of workers are expected, properly control maintenance schedule and processes and the traffic control plan including route-setting will be conducted. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact) (c) As traffic accident may happen during the operation stage, the project proponent will take mitigation measures below; - In case of using the roads in the residential area for periodic inspection, traffic of construction vehicles during school commuting hours shall be avoided -Checking of traffic regulations, installation of traffic signs, driving safety education, speed restriction, checkup of vehicle equipment (brake, horn) (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (d) Medical center will be installed and periodic medical check-ups will be conducted for workers (technical workers, etc.). Moreover, the education and health care training for workers will be conducted. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
4 Social Environment	(2) Living and Livelihood	(e) Is there a possibility that the amount of water used (e.g., surface water, groundwater) and discharge of thermal effluents by the project will adversely affect existing water uses and uses of water areas (especially fishery)?	(e) Y	(e) There are few large ships at the sea with more shoals in front of the plant, where water depth gets 7m around 1.3km off the coast. The fishing in front of the project site is prohibited, In addition, though some people enjoy fishing with small boats for a recreational purpose, any other recreation activities are not conducted along the seashore Installation of water taking and discharging facilities and changes in flow conditions may have impact on navigation of small boats of recreational fishing. The location of offshore water intake equipment shall be marked with a buoy installed around the equipment. Taking organisms by cooling water intake, pollutants discharged from plant waste water, and rises in the temperature of thermal water may also cause impact on the recreational fishing. Therefore, mitigation measures below will be taken; - Cooling water shall be taken from the lower water layer 6m deep at the low rate of 0.2m/s to minimize intake of fish and other marine organisms, and to avoid adverse impact on the operation of fishery vessels. - Water intake/discharge method shall be selected to minimize the area of water temperature rise. -Water pollution mitigation measures shall be conducted
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N/A	(a) Historical, cultural and/or archaeological property and heritage does not exist around the project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N/A	(a) There is no scenic area around the project site.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a) There is no minority group living around the project site. (b) -
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?"	(a) Y (b) Y (c) Y (d) Y	(a) The project proponent insisted on the compliance to the safety regulation and laws. (b) The project proponent will provide workers with appropriate protective equipment. (c) The project proponent will develop a safety and sanitation management plan and establish a manual for labor accident prevention including safety education and training. (d) Project proponent will subcontract a security firm to deploy security guards.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	(a) Y	(a) The following pollution-preventive measures will be taken by the project proponent and EPC Contractor. <Air pollution> - Periodic checkup and maintenance of heavy machine and vehicles - Shutdown of engine during waiting time - The rear deck of the sand-transport trucks shall be covered - Periodic car wash - Periodic watering of the site and surrounding road with the observation of dust caused by the strong winds, - Monitoring of ambient air in the residential area <Water pollution> - Installation of temporary rainwater drainage - Installation of temporary sedimentation pond and oil-separating system - Installation of septic tank and temporary toilet - Use of dredging method and equipment to minimize the turbidity - Dredged soil is not dumped into the sea - Monitoring of sea water quality <Waste and odor> - Development of waste management program including workers education - Prohibition of illegal dumping - Separation of waste by waste type, storage in an appropriate storage site and legal disposal in an appropriate disposal site - The record of the amount of generated waste and the disposal site <Noise and vibration> - Periodic checkup and maintenance of heavy machine and vehicles - Construction activity and traffic of vehicles is limited to daytime - Use low-noise/vibration type equipment - Temporary soundproof wall around the project site, if need - Piling is not conducted. -Furthermore, sound insulating walls will be installed as necessary. - Monitoring of noise level at site boundary and the residential area (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(1) Impacts during Construction	(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?"	(b) Y (c) Y	(b) Mitigation measures for air pollution, noise and vibration will be adequately implemented by the project proponent and EPC Contractor to reduce the impact on flora/fauna. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (c) The following preventive measures will be taken by the project proponent and EPC Contractor. <Infrastructure> - The rented houses in the surrounding area shall be used as much as possible. - Construct worker's camp with medical center and sewer systems <Traffic accident> - Determine the traffic control plan including route-setting - Training safe operation of vehicles. - Large machines shall be transported through the sea to the possible extent. - Land transportation shall use the existing highways and other existing roads shall be used as much as possible. - In case of using the roads in the residential area, traffic of construction vehicles during school commuting hours shall be avoided - Checking of traffic regulations, installation of traffic signs, driving safety education, speed restriction, checkup of vehicle equipment (brake, horn) <Public sanitation> - Compliance of safety laws and regulations - Development of safety and sanitation management plan and implementation - Installation of medical center and implementation of periodic medical check - Education and training on health care of the workers (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	(2) Accident Prevention Measures	(a) In the case of coal-fired power plants, are adequate measures planned to prevent spontaneous combustion at the coal piles (e.g., sprinkler systems)?	(a) N/A	(a) The project is not a coal-fired power plant.
5 Others	(3) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?		(a) An environmental monitoring plan is included in the EIA report. (Reference: Chapter 8.4 Environmental Monitoring Plan)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(3) Monitoring			(b) Main contents of monitoring are below; <Air Quality> -NOx ,SO2and Suspended particles will be monitored with ambient quality analyzer once a week at the construction phase -NOx will be monitored quarterly for three years from the operation <Gas emission> -NOx and CO will be monitored with continuous Emission Monitoring System (CEMS) <Waste Water> -pH, SS, and oil and grease will be monitored with sample analysis every week -Temperature, pH, Salinity, DO, COD, SS, oil and grease, ammonia, nitrite, nitrate, sulfate, phenol, chloride, Ca, Na, K, Phosphate, Fe, Cu, Zn, Cr, Pb will be monitored with automatic measuring and sample analysis every week <Sea Water Quality> -pH, SS, and oil and grease will be monitored with sample analysis at the dredging activity and drilling and filling at the construction phase -Temperature, pH, Salinity, DO, COD, SS, oil and grease, ammonia, nitrite, nitrate, sulfate, phenol, chloride, Ca, Na, K, Phosphate, Fe, Cu, Zn, Cr, Pb will be monitored with sample analysis quarterly for three year from the start of the operation <Noise> -Noise level will be monitored with sound-level meter with interval of 1hr for 24hr of 1 day, once a week at the construction phase -Noise level will be monitored with sound-level meter with interval of 1hr for 24hr of 1 day, quarterly year

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(3) Monitoring	(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(c) Y (d) N/A	(c) The project proponent establishes an adequate monitoring framework for the project during construction and operation phase. (Reference: Chapter 8.4 Environmental Monitoring Plan) (d) The environmental management administrator shall regularly conduct explanation to the local people and submit a report to MENR, JICA and other relevant organizations about the implementation status of the environmental management, in addition to the environmental monitoring. (Reference: Chapter 8 Environmental Plan and Monitoring Plan)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities). (b) Where necessary, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including construction of port and harbor facilities).	(a) Y (b) N/A	(a) The project proponent prepared EIA report for transmission line and gas pipeline. (b)The project does not involve construction and expansion of the port facility.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans boundary waste treatment, acid rain, destruction of the ozone layer, and global warming).	(a) N	(a) This project is adopted the high-efficiency combined cycle power generation system and maintenance of capacity of the facility. (Reference: Chapter 8.4 Environmental Monitoring Plan)

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are requested to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

13.11.2 Environmental Checklist of the Associated Projects

Table 13.11-2 shows Summary of EIA report about associated projects

Table13.11-3 and Table13.11-4 shows Checklist of Transmission line (including substation) and gas pipeline.

Table 13.11-2 Summary of EIA Report about Associated Projects

Item	Transmission line and substation	Gas pipeline	The residential housing for power plant staff
Title of EIA report	"Draft Report of Environmental Impact Assessment (EIA) for Construction of Yashma Gas Combined Cycle Power Plant And Associated Facilities"		
Construction Period	40 months		
Air quality Noise	Because area of tower base will be not large and numbers of heavy machinery and trucks will be few. Periodic maintenance and management of all the construction machinery and vehicles will be conducted to reduce exhaust gas discharged from construction machinery and vehicles.	Numbers of heavy machinery and trucks will be few. Periodic maintenance and management of all the construction machinery and vehicles will be conducted to reduce exhaust gas discharged from construction machinery and vehicles.	(Same of power plant)
Water quality	Since the substation and the power transmission line will be built in avoidance of river, soil of some embankments and earth cuts may not overflow into the river.	Gas pipeline route was selected avoiding any steep sloped areas. Preventing soil loss by stabilizing any slopes of construction areas with concrete will be conducted, as necessary based on geological survey	(Same of power plant)
Waste	The following measures will be taken for the management of waste - Development of waste management program including education of workers to encourage reduction and reuse of waste - Prohibition of illegal dumping - Separation of waste by waste type, storage in an appropriate storage site and legal disposal in an appropriate disposal site	Because numbers of workers and heavy machinery and trucks will be few, so but the volume of waste will be not large. Development of waste management program including education of workers to encourage reduction and reuse of waste will be promoted. Non-recyclable and hazardous waste will be stored and disposed at appropriate sites according to related regulations.	(Same of power plant)
Ecosystem	The site and route for the substation and transmission line have been designated in avoidance of forests. Although loss of habitat of animals and vegetation is expected, the influenced area is limited	The gas pipeline route has been designated in avoidance. There are precious kinds of plants and amphibians on the Red Book of Azerbaijan on	(Same of power plant)

Item	Transmission line and substation	Gas pipeline	The residential housing for power plant staff
	only within the basement area of the tower. − The power transmission line may cause bird strikes. Though the transmission line is within a migratory path of migrant birds, it shall be constructed along the existing transmission line to the possible extent in order to minimize. As the transmission of this project is about 40m at the highest, it will not influence on migrant birds flight In the case there is evidences of bird strikes at the periodic check, installing lights or signs to prevent birds from striking the transmission lines is considered, if needed.	the route but these inhabit not only the vicinity of the route. In addition, the construction period will be short-term because the pipeline will be buried in the underground and filled just after excavation.	
Others	Existing transmission line and substation are avoiding residential areas and landslide area. Most new transmission line will pass along existing transmission lines and remaining transmission lines and new substation will be avoiding private farm land and residential areas and landslide area.	The route of gas pipeline is almost a semi-desert area and will be avoiding private farm land and residential areas	House will be planted within the project site area
General/safety	- At the construction stage, labor and working conditions will be inspected. - The project proponent insisted on adhering to labor laws and regulations.	- At the construction stage, labor and working conditions will be inspected. - The project proponent insisted on adhering to labor laws and regulations.	(Same of power plant)

Table 13.11-3 Check List of Transmission Line and Substation

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) N (d) N	(a) The EIA preparation is on the process in an official way. (b) The EIA report will be submitted in August 2014 to the Ministry of Ecology and Natural Resources (MENR) which is responsible for the EIA process in Azerbaijan under Article 42 of 1999 Law of the Azerbaijan Republic on Protection of the Environment. (c) The EIA has not been approved yet. (d) The ecological passport described of the expected volume of air and water discharges, the quantity of expected water use, the expected amount of solid waste generated, etc. should be prepared by and applicant and submitted to MENR prior to the commercial operation. MENR will review this passport and approve the commercial operation of the project facility. (Reference: Draft Final p.13-33)
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is the understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) The first Public Consultation was held in Sumgait city on 11 April 2014 in order to give and explanation of the project overview and its environmental and social impacts to the local residents. 46 people attended, including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders. Any negative comments to the project were not obtained. The second public consultation was held in Sumgait city on 4 July 2014. in order to give and explanation of the project overview and its environmental and social impacts to the local residents. 51people attended, including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders. (Reference: Chapter 9.3 Public Consultation) (b) The comments will be adequately reflected in the project through environmental management plan.

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) N	(a) the plans for transmission line and substation have already been decided and alternative sites have not been considered. (Reference: Chapter7 Analysis of Alternatives)
2 Pollution Control	(1) Water Quality	(a) Is there any possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? If the water quality degradation is anticipated, are adequate measures considered?	(a) N	(a) Since the substation and the power transmission line will be built in avoidance of river , soil of some embankments and earth cuts may not overflow into the river.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country’s laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) No protected areas and national parks are within the proposed transmission line route. (Reference: Chapter 4.1 Protected Area and Park)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country’s laws or international treaties and conventions?	(a) N (b) Y	(a) Most of transmission line corridor is located on a semi- desert area. Some places are, however, small meadow areas, which were formed by groundwater and rainwater. (Reference: Chapter 4 Existing Environment: Ecological) (b) Field survey found several species which are listed on the Azerbaijan Red Book, ’ Critically Endangered ‘,’Endangered’, ‘Vulnerable’, ‘Near Threatened’ of the IUCN Red List or targeted by CITES. These include one specie of Reptiles, and 2 of birds. These names are below; [Reptile] - *Tesyudo graeca* (‘Vulnerable’ on the Azerbaijan and IUCN Red Book, targeted by CITES) [Birds] - *Buteo rufinus* (‘Endangered’ on the Azerbaijan and IUCN Red Book, targeted by CITES) - *Upupa epops* (‘Least Concern’ on the IUCN Red Book, targeted by CITES) (Reference: Chapter 4 Existing Environment: Ecological)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	(2) Ecosystem	(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife and livestock? (e) Is there any possibility that the project will cause the negative impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystem due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases where the project site is located in undeveloped areas, is there any possibility that the new development will result in extensive loss of natural environments?	(c) N (d)N/A (e)N/A	(c) Six observed kinds of migratory birds flew more than 100m high, which are enough above the transmission lines (about 40m). Moreover, there are no rivers and lakes along them. Therefore, impacts by bird strike is expected to be low. It will be monitored whether bird strike will happen during the mantenance. Lights and signs, etc. will be installed in order to avoid bird strikes, if needed. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (d) The site and route for the substation and transmission line have been designated in avoidance of forests. Although Loss of habitat of animals and vegetation is expected, the influenced area is limited only within the basement area of the tower. (Reference: Chapter 6.1 Selection of assessment items (Scoping)) (e) Proposed sites of tower foundation and transmission line route are almost all in semi-desert land. (Reference: Chapter 4 Existing Environment: Ecological) (e) Proposed sites of tower foundation and transmission line route are almost all in semi-desert land. (Reference: Chapter 4 Existing Environment: Ecological)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
3 Natural Environment	(3) Topography and Geology	(a) Is there any soft ground on the route of power transmission and distribution lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there any possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a)Y (b)Y (c)N	(a) According to visual observation results, soils on the route are mainly sand and loamy sand interbeds, weak-moist, of semi-hard and hard consistency. (Reference Chapter 3.7 Topography and Geology) (b) The site and the route are in a flat area. Thus, landslides will not occur. (Reference: Chapter 6.1 Selection of assessment items (Scoping)) (c) The site and the route are in a flat area and sediment runoff will not occur. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly	(a)N (b)N/A (c)N/A (d)N/A (e)N/A (f)N/A (g)N/A (h)N/A (i)N/A (j)N/A	(a) The substation site and the power transmission line route are governmental land and not been privately used for farm land and residential area, etc. Therefore, involuntary resettlement is not caused by the project. (Reference: Chapter 6.1 Selection of assessment items (Scoping)) (b)～(j) -

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
		implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?		
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (c) Is there any possibility that installation of structures, such as power line towers will cause a radio interference? If any significant radio interference is anticipated, are adequate measures considered? (d) Are the compensations for transmission wires given in accordance with the domestic law?	(a) N (b) Y (c) N (d) N	(a) Since the substation site and the transmission line route are governmental land and not been used for farmland and residential area, the project will have no impacts. Instead, the project will bring benefit to local people including increase of local employment and more opportunities to offer local services and products. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact) (b) A temporary influx of the small number of migrant labor during construction period may increase the risk of sexual transmitted diseases, etc. Local people should be recruited for simple work as much as possible to minimize the risk of infectious diseases being transmitted from external workers. Pre-employment and periodic medical check-ups should be conducted for external workers. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact) (c) Project proponent designs the transmission line route to avoid running through residential areas. (Reference: Chapter 2.1 Project Location) (d) Since the proposed transmission line route avoids residential area, any compensation is not required. (Reference: Chapter2.1 Project Location)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)N/A	(a)Historical, cultural and/or archaeological property and heritage does not exist around the proposed substation site and transmission line route. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)N/A	(a)There is no scenic area around the proposed substation site and transmission line route. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a)There is no minority group living around the substation site and transmission line route. (Reference: Chapter 6.1 Selection of assessment items (Scoping)) (b) N/A
	(6) Working Conditions	"(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?"	(a) Y (b) Y (c) Y (d) Y	(a) The project proponent insisted on adhering to labor laws and regulations. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (b) The project proponent will provide workers with appropriate protective equipment. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (c) The project proponent will develop a safety and sanitation management plan and establish a manual for a labor accident prevention including safety education and training. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (d) Project proponent will subcontract a security firm to deploy security guards. (Reference: Chapter 6.1 Selection of assessment items (Scoping))

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	(a) Y	(a) The following pollution-preventive measures will be taken by the project proponent and EPC Contractor. <Air pollution> -Periodic checkup and maintenance of vehicles -Shutdown of engine during waiting time -Periodic car wash <Waste> - Development of waste management program including education of workers to encourage reduction and reuse of waste - Prohibition of illegal dumping - Separation of waste by waste type, storage in an appropriate storage site and legal disposal in an appropriate disposal site <Noise and vibration> - Periodic checkup and maintenance of heavy machine and vehicles -Construction activity and traffic of vehicles is essentially limited to daytime (Reference: Chapter 8.4 Environmental Monitoring Plan)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(1) Impacts during Construction	(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?"	(b) Y (c) Y	(b) The following measures will be taken by the project proponent and EPC Contractor. - The transmission line shall be constructed along the existing transmission line to the possible extent in order to minimize the area of alternation. - Prohibit disturbance, harassment, and hunting by workers - Implementation of mitigation measures for air pollution (Reference: Chapter 8 Environmental Management Plan and Monito ring Plan) (c) The following measures will be taken by the project proponent and EPC Contractor. <Traffic accident> - Land transportation shall use the existing highways and other existing roads shall be used as much as possible. - In case of using the roads in the residential area, traffic of construction vehicles during school commuting hours shall be avoided - Checking of traffic regulations, installation of traffic signs, driving safety education, speed restriction, checkup of vehicle equipment (brake, horn) <Public sanitation> - Compliance of safety laws and regulations - Development of safety and sanitation management plan and implementation - Installation of medical center and implementation of periodic medical check - Education and training on health care of the workers (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) N/A	(a) An environmental monitoring plan is included in the EIA. (Reference: Chapter 8.4 Environmental Monitoring Plan) (b) At the construction stage, the type and amount of waste will be monitored with state on recycling and waste disposal continuously. Additionally, labor and working conditions will be inspected. (Reference: Chapter 8.4 Environmental Monitoring Plan) (c) The project proponent establishes an adequate monitoring framework for the project during construction and operation phase. (d) The environmental management administrator shall regularly conduct explanation to the local people and submit a report to MENR, JICA and other relevant organizations about the implementation status of the environmental management, in addition to the environmental monitoring. (Reference: Chapter 8 Environmental Plan and Monitoring Plan)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Road checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).	(a) N	(a) This project will use the existing roads built for the construction and maintenance of the existing transmission line.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans boundary or global issues should be confirmed, (e.g., the project includes factors that may cause problems, such as trans boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) CO_2 will be generated during the construction, but the impact is limited to a temporal period. Periodic checkup and maintenance of heavy machine and vehicles will be conducted. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact)

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are requested to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.
Source: EIA report and JICA Study Team

Table 13.11-4 Check List of Gas Pipeline

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) N (d) N	(a) The EIA preparation is on the process in an official way. (b) The EIA report will be submitted in August 2014 to the Ministry of Ecology and Natural Resources (MENR) which is responsible for the EIA process in Azerbaijan under Article 42 of 1999 Law of the Azerbaijan Republic on Protection of the Environment. (Reference: Chapter 1.4 Regulation and guideline regarding project activity) (c) The EIA has not been approved yet. (d) The ecological passport described of the expected volume of air and water discharges, the quantity of expected water use, the expected amount of solid waste generated, etc. should be prepared by and applicant and submitted to MENR prior to the commercial operation. MENR will review this passport and approve the commercial operation of the project facility. (Reference: Draft Final p.13-33)
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is the understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) The first Public Consultation was held in Sumgait city on 11 April 2014 in order to give and explanation of the project overview and its environmental and social impacts to the local residents. 46 people attended, including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders. Any negative comments to the project were not obtained. The second public consultation was held in Sumgait city on 4 July 2014. in order to give and explanation of the project overview and its environmental and social impacts to the local residents. 51people attended, including community members from Sumgait and Z. Tagiyev settlement, local press, Azerbaijani consultants and specialists from Sumgait Power Plant. Azerenerji announced the organization of the stakeholder meeting by local newspaper and direct contact to stakeholders. (Reference: Chapter 9.3 Public Consultation) (b) The comments will be adequately reflected in the project through environmental management plan.

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternatives were examined and the route was determined with social and environmental considerations. (Reference: Chapter 7 Analysis of Alternatives)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
2 Pollution Control	(1) Air Quality	(a) Do air pollutants, (such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust) emitted from the proposed infrastructure facilities and ancillary facilities comply with the country's emission standards and ambient air quality standards? Are any mitigating measures taken? (b) Are electric and heat source at accommodation used fuel which emission factor is low?	(a) Y (b) N	(a) No air pollutants will be generated during the operation phase. (Reference: Chapter 6.1 Selection of assessment items (Scoping)) (b) The area near access road is cultivated land, pastureland, and unusable land.
	(2) Water Quality	(a) Do effluents or leachates from various facilities, such as infrastructure facilities and the ancillary facilities comply with the country's effluent standards and ambient water quality standards?	(a) N	(a) No waste water will be generated during the operation phase. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(3) Wastes	(a) Are wastes from the infrastructure facilities and ancillary facilities properly treated and disposed of in accordance with the country's regulations?	(a) N	(a) No waste will be generated during the operation phase. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(4) Soil Contamination	(a) Are adequate measures taken to prevent contamination of soil and groundwater by the effluents or leachates from the infrastructure facilities and the ancillary facilities?	(a) N	(a) Lubrication oil and fuel oil may not be occurred at periodical inspections. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(5) Noise and Vibration	(a) Do noise and vibrations comply with the country's standards?	(a) N	(a) Since gas compressor will not be installed, no noise will be generated. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(6) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) Water will not be drawn up from underground. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(7) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) N	No waste will be generated. (Reference: Chapter 6.1 Selection of assessment items (Scoping))

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The proposed gas pipeline route is not on the protected areas and national parks. (Reference: Chapter 4.1 Protected Area and Park)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that changes in localized micro-meteorological conditions, such as solar radiation, temperature, and humidity due to a large-scale timber harvesting will affect the surrounding vegetation? (d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) Y (c) N (d) N	(a) The corridor of the gas pipeline mainly goes through semi-desert and desert areas. (Reference: Chapter 4 Existing environment: Ecological) (b) Field survey found several species which are listed on the Azerbaijan Red Book, ' Critically Endangered ','Endangered', 'Vulnerable', 'Near Threatened' of the IUCN Red List or targeted by CITES. These include three species of Reptiles and two of birds. These names are below; [Reptile] - *Tesyudo graeca* ('Vulnerable' on the Azerbaijan and IUCN Red Book, targeted by CITES) - *Vipera lebetina obtuse* ('Near Threatened' on the IUCN Red Book, targeted by CITES) - *Elaphe quatuorlineata* ('Near Threatened' on the IUCN Red Book) [Birds] - *Buteo rufinus* ('Endangered' on the Azerbaijan Red Book, 'Least Concern' on the IUCN Red Book, targeted by CITES) - *Haliaeetus albicilla* ('Least Concern' on the Azerbaijan and IUCN Red Book, targeted by CITES) (Reference: Chapter 4 Existing Environment: Ecological) (c) The gas pipeline route has been designed in avoidance of forests. Therefore, a large-scale timber harvesting will not happen, which will result in little impacts on surrounding vegetation. (d) River water and underground water will not be taken in. (Reference: Chapter 6.1 Selection of assessment items (Scoping))

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the project will adversely affect surface water and groundwater flows?	(a) N	(a) Any changes in the surrounding hydrology will not occur since river water and underground water will not be taken in. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
3 Natural Environment	(4) Topography and Geology	(a) Is there a possibility the project will cause large-scale alteration of the topographic features and geologic structures in the project site and surrounding areas?	(a) Y	(a) The gas pipeline route contains mountainous terrain (70%) and flat terrain (30%) so soil flowage may occur during construction. (Reference: Chapter 3.7 Topography and Geology Chapter 6.1 Selection of assessment items (Scoping))

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a)N (b)N/A (c)N/A (d)N/A (e)N/A (f)N/A (g)N/A (h)N/A (i)N/A (j)N/A	(a) The route of gas pipeline is almost a semi-desert area and will be avoiding private farm land and residential areas. Therefore, involuntary resettlement is not by the project. (Reference: Chapter 6.1 Selection of assessment items (Scoping)) (b)～(j) -
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	(a) N	(a) Since the site is governmental land and not been used for farmland and residential area, the operation will have no impact. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact)

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N/A	(a) Historical, cultural and/or archaeological property and heritage does not exist around the gas pipeline. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken? (b) Is there a possibility that landscape is spoiled by construction of high-rise buildings such as huge hotels?	(a) N/A	(a) There is no scenic area around the gas pipeline. (Reference: Chapter 6.1 Selection of assessment items (Scoping))
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a)There is no minority group living around the gas pipeline route. (Reference: Chapter 6.1 Selection of assessment items (Scoping)) (b) N/A
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The project proponent insisted on the compliance to the labor laws and regulations (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (b) The project proponent will provide workers with appropriate protective equipment. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (c) The project proponent will develop a safety and sanitation management plan. In addition, a manual will be established for labor accident prevention including safety education and training. (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (d) Project proponent will subcontract a security firm to deploy security guards. (Reference: Chapter 6.2 Impact assessment and measures for avoiding or mitigating the impact)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	(a) Y (b) Y	(a) The following pollution-preventive measures will be taken by the project proponent and EPC Contractor. <Air pollution> - Periodic checkup and maintenance of heavy machine and vehicles - Shutdown of engine during waiting time - Periodic car wash <Waste> - Development of waste management program including education of workers to encourage reduction and reuse of waste - Prohibition of illegal dumping - Separation of waste by waste type, storage in an appropriate storage site and legal disposal site <Noise and vibration> - Prohibition of construction work during nighttime -Periodic checkup and maintenance of heavy machine and vehicles Construction activity and traffic of vehicles is essentially limited to daytime (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan) (b) The following pollution-preventive measures will be taken by the project proponent and EPC Contractor. <Terrestrial ecosystem> - The gas pipeline shall be constructed along the existing road as much as possible to minimize the area of alternation. - Prohibit disturbance, harassment, and hunting by workers - Implementation of mitigation measures for air pollution, noise and vibration <Topography and geology> - Gas pipeline route was selected avoiding any steep sloped areas to prevent soil flowage - Preventing soil loss by stabilizing any slopes of construction areas with concrete, as necessary based on geological survey (Reference: Chapter 8 Environmental Management Plan and Monitoring Plan)

<table>
<tr><th>Cate gory</th><th>Environmental Item</th><th>Main Check Items</th><th>Yes: Y
No: N</th><th>Confirmation of Environmental Considerations
(Reasons, Mitigation Measures)"</th></tr>
<tr><td>5 Others</td><td>(1) Impacts during Construction</td><td>(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?</td><td>(c) Y</td><td>(c) The following pollution-preventive measures will be taken by the project proponent and EPC Contractor.
<Social infrastructure >
- Employment of local residents as many as possible
- Determine the traffic control plan including route-setting
- Training safe operation of vehicles
<HIV/AIDS and other infectious diseases>
- Implementation of periodic medical check
- Education and training on health care of the workers
(Reference: Chapter 8 Environmental Management Plan and Monitoring Plan)</td></tr>
<tr><td>5 Others</td><td>(3) Monitoring</td><td>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?
(b) What are the items, methods and frequencies of the monitoring program?
(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?
(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</td><td>(a) Y
(b) Y
(c) Y
(d) Y</td><td>(a) An environmental monitoring plan is included in the EIA.
(Reference: Chapter 8.4 Environmental Monitoring Plan)
(b) At the construction stage, the type and amount of waste will be monitored with state on recycling and waste disposal continuously. Additionally, labor and working conditions will be inspected.
(Reference: Chapter 8.4 Environmental Monitoring Plan)
(c) The project proponent establishes an adequate monitoring framework for the project during construction and operation phase.
(d) The environmental management administrator shall regularly conduct explanation to the local people and submit a report to MENR, JICA and other relevant organizations about the implementation status of the environmental management, in addition to the environmental monitoring.
(Reference: Chapter 8 Environmental Plan and Monitoring Plan)</td></tr>
<tr><td>6 Note</td><td>Reference to Checklist of Other Sectors</td><td>(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).
(b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).</td><td>(a) N
(b) N</td><td>(a) Since the gas pipeline route has been designated in avoidance of forests, large areas deforestation will not occur.
(Reference: Chapter 6.1 Selection of assessment items (Scoping))
(b) Transmission line is shown in Table8.12.1-2.</td></tr>
</table>

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)"
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) Although CO2 is generated during construction, the impact is limited to a temporal period and hardly expected to take place across the borders and on climatic change. (Reference: Chapter 6.1 Selection of assessment items (Scoping))

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

13.11.3 Monitoring Form

Monitoring items shall be decided on with reference to the kind of sector, the characteristic of the project etc. According to this project, monitoring items are as follows.

(1) Construction phase

(a) Air pollution

<Ambient air quality>

Location: The residential area (Decision after detail design)

Regulation and Guidance: IFC/ EHC Guideline General; 2007

Unitμg/m^3

Date	Item	Measured Value (1hr)			IFC/ EHC Guideline General;2007	EU Standards (Japanese Standards)	Remark
		Min	Max	Average			
	SO_2				500(10 min) 125(24hour)		Once a week at the maximum construction activity.
	NO_2				200(1-hour) -	200(1hr) (110)(24hr)	
	NO				-	-	
	Dust				- 150(24hr)	(200)(1hr) 150(100)(24hr)	

(b) Water pollution

<Waste water: Sedimentation pond>

Location: Outlet

Regulation:

Sampling Date:

Item	Unit	Measured Value	Remark
pH	―		Every week
SS	mg/L		
Oil & Grease	mg/L		

<Sea water quality >

Location:

Regulation: Rules on protection of surface waters from pollution by waste waters Baku, 1994

Sampling Date:

Location: Regulation: Rules on protection of surface waters from pollution by waste waters Baku, 1994

Sampling Date:

Item	Unit	Measured Value	Azerbaijan Water quality standard	Remark
pH	―		6,5~8,5	At the dredging activity and drilling and filling.
SS	mg/L		35	
Oil and Grease	mg/L		0.05	

(c) Waste

Location: Project site and associated facilities
Regulation: the Law of Azerbaijan Republic on Industrial and Domestic Waste No. 514-IQ
Reporting Date;

Item	Place of generated waste	Storage amount (Unit: t or kg)	Disposal amount (Unit: t or kg)	Disposal method and place	Remark
					Continuously

(d) Noise

Location: Site boundary and residential area (Decision after detail design)
Regulation: Recommendations on Environment Protection in Road and Bridge Design, Moscow, 1995
Measurement Date:

Date (Period)	Location	Average (Leq)	Azerbaijan Noise standards	IFC/ EHC Guideline (General; 2007) residential area	Remark
	Residential area		Residential area Day: 60 Night: 45	Residential area Day: 55 Night: 45	Once a week at the maximum construction activity. with interval of 1hr for 24hr of 1 day,
	Site boundary		Industrial area Day: 65 Night: 55	Industrial area Day: 70 Night: 70	

(e) Ecosystem

<Sea Grass>
Location: Shallow water area within 2km from outlet
Sampling and observation Date:

(Unit:g/m^2)

Species		North 200m from outlet	North 500m from outlet	North 1km from outlet	South 200m from outlet	South 500m from outlet	South 1km from outlet	Remark
1								3 years from the start of the operation. Spring and summer
2								
·								
Total								

<Caspian Seal > : visual observation
Location: Surrounding of Intake tower and facing of the site
Observation Date:

(f) Labor and working conditions

Location: Project site

Reporting Date;

Construction Contents	Inspection Item	Contents	Status	Provision	Remarks
					Continuously

(g) Grievances

Location: Project site

Date	Name	Contents	Status	Results	Remarks
					Continuously

(3) Operation phase

(h) Air pollution

<Ambient air quality >

Location: residential area (Decision after detail design)

Regulation and Guidance: IFC/ EHC Guideline General; 2007

Unitμg/m^3

Date	Item	Measured Value (1hr)			IFC/ EHC Guideline General;2007	EU Standards （Japanese Standards）	Remark
		Min	Max	Average			
	SO_2				500(10 min) 125(24hour)		3 years from the start of the operation. Quarterly, Once a week
	NO_2				200(1-hour) -	200(1hr) (110)(24hr)	
	NO				-	-	
	Dust				- 150(24hr)	(200)(1hr) 150(100)(24hr)	

<Emission gas>

Location: Gas duct

Regulation and Guidance: IFC/ EHC Guideline Thermal Power Plant; 2008

Date:

Parameter	Unit	Min –Max	Excess period of the standard	IFC/ WB EHC Guideline (Thermal Power Plant; 2008) <Gas fuel>	Remarks
NO_X	mg/Nm^3			51	Fuel: Gas Continuously

Note dry gas base,O_2=15%

(i) Water pollution

<Thermal water>

Location: Outlet of condenser

Regulation:
Sampling Date:

Item	Unit	Measured Value	IFC/WB EHS Guidelines	Remark
Temperature	―		-	Continuously
Salinity	‰		-	
Residual chlorine	mg/L		0.2	

< Plant Waste water>
Location: Outlet of waste treatment facility
Regulation:
Sampling Date:

Item	Unit	Measured Value	IFC/WB EHS Guidelines	Remark
pH	-		6.5-9.0	Every month
DO	mg/L		-	
COD	mg/L		25	
SS	mg/L		50	
Oil and Grease	mg/L		10	
Phenol	mg/L		-	
Ammonia	mg/L		-	
Nitrites	mg/L		-	
Nitrates	mg/L		-	
Phosphate	mg/L		-	
As	mg/L		0.5	
Cd	mg/L		0.5	
Cu	mg/L		0.5	
Fe	mg/L		1.0	
Pb	mg/L		0.5	
Hg	mg/L		0.005	
Zn	mg/L		0.5	
Cr			0.5	

< Domestic wastewater>
Location: Discharge point of domestic wastewater
Regulation:
Sampling Date:

Item	Unit	Azerbaijan Standard value	IFC/WB EHS guidelines (general)	Remark
Temperature	C°	40	-	- Every month
pH	―	6.5 - 7.5	6－9	
SS	mg/L	15	50	
COD	mg/L	500	125	
Oil & Grease	mg/L	0.4	10	
Total nitrogen	mg/L	-	10	
Total phosphorus	mg/L	-	2	
Total coliform bacteria	MPN/100ml	-	400	

Reference: Order No.219 dated 10.02.1993 of Baku Executive Power regarding discharged water into the sewerage systems and IFC/WB EHS Guidelines General, 2007

<Sea water quality >
Location: Regulation: Rules on protection of surface waters from pollution by waste waters Baku, 1994
Sampling Date:

Item	Unit	Measured Value	Azerbaijan Water quality standard	Remark
Water temperature	^{o}C		⊿5	3 years from the start of the operation. Quarterly
Salinity			-	
pH	―		6.5～8.5	
DO	mg/L		≥4.0-6.0	
COD	mg/L		125	
SS	mg/L		35	
Oil and Grease	mg/L		0.05	
Phenol	mg/L		0.001	
Ammonia（NH_4）	mg/L		0.5	
Nitrite(NO_2)	mg/L		0.08	
Nitrate(NO_3)	mg/L		45	
Phosphate,	mg/L		-	
As	mg/L		0.05	
Cd	mg/L		0.005	
Cu	mg/L		0.01	
Fe	mg/L		0.05	
Pb	mg/L		0.03	
Mn	mg/L		0.1	
Hg	mg/L		0.0001	
Ni	mg/L		0.01	
Zn	mg/L		0.01	
Co	mg/L		0.01	
Al	mg/L		0.05	

(j) Waste
Location: Project site
Regulation: the Law of Azerbaijan Republic on Industrial and Domestic Waste No. 514-IQ
Reporting Date;

Item	Place of generated waste	Storage amount (Unit: t or kg)	Disposal amount (Unit: t or kg)	Disposal method and place	Remark
					Continuously

(k) Noise
Location: Site boundary and residential area (Decision after detail design)
Regulation: Recommendations on Environment Protection in Road and Bridge Design, Moscow, 1995
Measurement Date:

Date (Period)	Location	Average (Leq)	Azerbaijan Noise standards	IFC/ EHC Guideline (General; 2007) residential area	Remark
	Residential area		Residential area Day: 60 Night: 45	Residential area Day: 55 Night: 45	Quarterly a year with interval of 1hr for 24hr of 2 day
	Site boundary		Industrial area Day: 65 Night: 55	Industrial area Day: 70 Night: 70	

(l) Ecosystem
<Sea Grass>
Location: Shallow water area within 2km from outlet
Sampling and observation Date:

(Unit:g/m^2)

Species		North 200m from outlet	North 500m from outlet	North 1km from outlet	South 200m from outlet	South 500m from outlet	South 1km from outlet	Remark
1								3 years from the start of the operation. Spring and summer
2								
・								
Total								

<Caspian Seal and other mammals > : visual observation
Location: Surrounding of Intake tower and facing of the site
Observation Date:

(m) Labor and working conditions
Location: Project site
Reporting Date;

Construction Contents	Inspection Item	Contents	Status	Provision	Remarks
					Continuously

(n) Grievances
Location: Project site

Date	Name	Contents	Status	Results	Remarks
					Continuously

Chapter 14

Workshop in Japan

Chapter 14 Workshop in Japan

14.1 Purpose of Workshop

This workshop was held in order to share findings and experiences that could be effectively employed in the phase of implementing a yen loan project in the future. Counterparts in Azerbaijan were invited to Japan to take a field trip to the factories of major equipment manufacturers and combined cycle power plants and listen to the lectures on the power grid system in such a way that the people concerned would be equipped with the information they require.

14.2 Schedule and Lists of Trainees in Workshop

With the cooperation of Japanese gas turbine manufacturers, Azerenerji JSC's trainees were invited to visit a Takasago turbine factory on March 26th and 27th 2014. The trainees also visited TEPCO's Boso Substation and Chiba Thermal Power Station March on 25th, 2014 to extend their knowledge regarding the operation and maintenance of a substation and combined cycle power plant.

Azerenerji JSC's trainees are listed in Table 14.2-1.

Table 14.2-1 List of Azerenerji JSC's Trainees

No	Position	
1	Azerenerji JSC	Head of Accounting and Analysis Department
2	Azerenerji JSC	Head of Ecology Department
3	Azerenerji JSC	Deputy Chief of the Unit for Operation and Maintenance of Thermal Equipment, Power Generation Department
4	Azerenerji JSC	Lead Engineer, Sumgayit Power Plant
5	Azerenerji JSC	Dispatcher, Central Dispatch Unit, Central Dispatch Department
6	Azerenerji JSC	Head of Certification, Metrology and Automation Department
7	Baku University	Translator

14.3 Workshop Contents

(1) Kick off meeting (TEPSCO) and Lecture (TEPCO)
    Date: March 24, 2014
    Item: Introduction and Lecture on Thermal Power Generation & Power Grid System

Figure 14.3-1 Kick off Meeting (TEPSCO) and Lecture (TEPCO)

(2) TEPCO's Boso Substation and Chiba Thermal Power Station
Date: March 25, 2014
Item: Tour of TEPCO's Substation and Combine Cycle Power Station

Figure 14.3-2 Visit to TEPCO's Boso Substation and the Chiba Thermal Power Station

(3) Gas Turbine Manufacturing Factory
Date: March 26, 27, 2014
Item: Tour of gas turbine manufacturing factory

Figure 14.3-3 Visit to a Gas Turbine Manufacturing Factory

(4) Wrap-up meeting at JICA
Date: March 28, 2014
Item: Overview of Workshop in Japan

Figure 14.3-4 Visit to JICA

Chapter 15

Conclusions

Chapter 15 Conclusions

15.1 Conclusions

The Yashma CCPP construction project has been determined to be feasible in both the technological and economic aspects, as a result of this Preparatory Survey. The Yashma CCPP Project is a new construction plan for two single shafts, total capacity 900 to 950 MW of natural gas fired combined cycle power plant.

Generally, the thermal power plant can be classified into three types - coal fired, oil fired and gas fired thermal power plants. Environmental protection measures differ according to the fuel used. The coal fired thermal power plant requires measures against the sulfur oxide and nitrogen oxides as well as the particulate matters and dust particles scattering from a coal storage yard. The gas fired thermal power plant requires measures to be taken mainly against nitrogen oxides, because the amounts of sulfur oxide and suspended particulate substances are negligibly small in generation. Thus, as viewed from an environmental point of view, the impact of the gas fired thermal power plant can be the least amongst the thermal power plants, because of the nature of the fuel that is used. Furthermore, the combined cycle power plant is based on the generation system characterized by high energy efficiency and high energy saving efficiency. This is expected to make a significant contribution in the saving of energy resources.

The planned site of the power plant is the property of the Azerbaijan government. Environment Impact Assessment (EIA) for the Yashma CCPP project has already been completed, and the EIA approval process is under way in Azerbaijan. When consideration is given to a power plant that meets growing electricity demand and operates as a base power source replacing the existing aged power plants, the Yashma CCPP Construction Project which has satisfied all construction site requirements should be regarded as top priority. Through introduction of a high-efficiency power generation technology, reduced emission of nitrogen oxide is expected. This technology can also reduce the consumption of Natural Gas as a fuel for power generation by a greater percentage. There is a sufficient reason to support this project when consideration is given to the future power supply-demand balance and necessity of efficient use of Natural Gas within the country.

15.2 Recommendations

To implement the Yashma CCPP Construction Project, Azerenerji JSC - as the Azerbaijan counterpart - is required to take the following actions:

a. The key point is in financing. This project - including Transmission Line & Substation and Fuel Gas pipeline development should be defined as a national project, and a detailed overall strategic plan should be worked out. In case of funding gap, actions should then be taken to work on the international financial institutions on a nationwide basis. Moreover, it is necessary to select the proper strategic partner carefully and to advance in a direction beneficial for the Republic of Azerbaijan.

b. The repayment schedule equally important to the fund procurement. It is desirable that electricity tariff surely cover the construction cost, operation and maintenance cost. For this purpose, it is necessary to reconsider the electricity tariff system in order to establish the repayment schedule.

c. In order to reduce the construction costs, use of local materials, equipment and work/services wherever possible, is recommended. Detailed survey of the capabilities, performance records, availability of the leading Azerbaijan manufacturers and construction companies is recommended.

d. To enhance the feasibility of this Project, a preferential tax treatment will be required. Preliminary coordination with related governmental agencies must be arranged to ensure exemption from customs duties on imported products for this Project and salary/allowance paid to the overseas instructors, and simplification of the procedures.

e. Expedite the clearance process of the environment impact assessment for this Project.