Environmental and Social Impact Assessment Draft Report

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Yerevan 2 CC Power Plant
Armpower SJSC

Environmental and Social Impact Assessment - DRAFT

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FICHTNER

FICHTNER

Sarweystrasse 3
70191 Stuttgart • Germany
Phone: +49 711 8995-0
Fax: +49 711 8995-459

Please contact: **Sofia Sousa**
Extension: **726**
E-mail: **Sofia.Sousa@fichtner.de**

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Acronyms and Abbreviations

ADB	Asian Development Bank
ADC	Air Dispersion Calculation
CCPP	Combined Cycle Power Plant
CEMS	Continuous Emissions Monitoring System
CJSC	Closed Joint Stock Company
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement, Construction
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GIIP	Good International Industry Practice
GLC	Ground Level Concentration
GT	Gas Turbine
GRM	Grievance Redress Mechanism
HHV	Higher Heating Value
HRSG	Heat Recovery Steam Generator
HSE	Health Safety and Environment
HSEMP	Health, Safety and Environment Management Plan
HSEMS	Health, Safety, and Environment Management System
IBA	Important Bird and Biodiversity Area
IFC	International Financing Corporation
IFIs	International Financing Institutions
ILO	International Labor Organization
kV	Kilo Volt
LHV	Lower Heating Value
MNP	Ministry of Nature Protection
MOE	Ministry of Energy and Natural Resources of RA
MPC	Maximum Permissible Concentration
MW	Mega Watt
NGO	Non-Governmental Organization
NPS	Noise Propagation Study
PAP	Project Affected People
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
PS	Performance Standards
RA	Republic of Armenia
SEP	Stakeholder Engagement Plan
SNCO	State Non-Commercial Organization
ST	Steam Turbine
UHC	Unburned Hydrocarbons
USD	US Dollar
WHO	World Health Organization

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1. Executive Summary

1.1 Project Background and Objectives

The Ministry of Energy (MOE) of the Republic of Armenia plans to improve the total output capacity of its electric energy production, complementing the power units of the existing Yerevan Combined Cycle Thermal Power Plant (YCCPP-1) with a modern and efficient power plant. For this reason a new gas fired Combined Cycle Power Plant of 254 MWe (YCCPP-2) is planned to be built at the site next to the existing YCCPP-1.

To obtain financing from the International Financing Corporation (IFC), a bankable Environmental and Social Impact Assessment (ESIA) Report regarding the YCCPP-2 ("the Project") on the basis of the relevant World Bank Group's guidelines has to be delivered to IFC for review and approval.

The new CCPP will include a Gas Turbine (GT), a Steam Turbine (ST), and a Heat Recovery Steam Generator (HRSG) and all auxiliary equipment and systems that, at local conditions with an ambient temperature of 15°C, will produce 254 MW. Interconnections to gas, water and electrical grid are already in place (the new CCPP will use interconnections of the existing YCCPP-1).

Along with a rapidly growing economy and a rising population, power demand in Armenia is constantly increasing. The main objective of the construction of YCCPP-2 is to:

- Improve the total output capacity of electric energy production;
- Provide reliable power supply;
- Shift the financial burden for power generation from the government to the private sector;
- Promote commercial development of thermal technology and cost reduction that enables Armenia to become a major net exporter of electricity; and
- Build and sustain local capacity in the development and maintenance of power generation infrastructure.

1.2 Objectives and Methodology of the ESIA Study

On the basis of the existing environmental situation and the technical planning of the power plant, FICHTNER determined and evaluated the environmental and social impacts during construction and operation of the planned YCCPP-2. The impact assessment focused on the ecological aspects of the Project and on the effects for the local population. In a second step appropriate mitigation measures and monitoring measures were considered to reduce possible adverse impacts.

After public disclosure of the ESIA, including the ESMP, public consultations will be executed in order to seek feedback and concerns of

stakeholders and people possibly affected by the Project. A Stakeholder Engagement Plan has also been prepared as part of this ESIA study.

A general overview about biophysical settings has been done as a desktop study, including existing studies about the Project. A field survey was conducted by FICHTNER's environmental and social experts in July 2017, visiting the proposed CCPP site. The environmental and social impacts of the Project are predicted in relation to environmental and social receptors and natural resources. This is accomplished by comparing baseline conditions with situations ensuing when the Project is implemented. Additional information was gained by consultations of representatives of governmental and non-governmental organizations.

To obtain up-to-date data about the ground level concentrations (GLC) of air pollutants in the Project Area, and help defining the airshed as degraded or non-degraded (according to the WB EHS Guidelines), FICHTNER undertook an air quality monitoring campaign including the measurement of SO_2, NO2 and PM_{10}. This monitoring campaign will be repeated in next autumn, winter and spring in order to cover all seasons of an annual cycle. The results will be used as an input for a new simulation and an updated Air Dispersion Calculation report.

To obtain data about the existing noise levels in the Project Area, FICHTNER undertook a noise monitoring campaign in an area around the YCCPP-2 site at five monitoring points. The results were used as an input for a Noise Propagation Study report.

Due to the fact that there is no official international consensus on an agreed approach for assessing the significance of impacts on the environment, FICHTNER uses an own evaluation procedure. This transparent evaluation procedure is based upon FICHTNER's extensive experience over the last fifteen years in performing Environmental and Social Impact Assessments and has proven to be a reliable method for assessing a project's impacts on the environment. It includes identification, prediction and evaluation of the significance of impacts based on legal requirements. Wherever possible, impacts are quantified. The focus of the used evaluation procedure is to decide whether the Project is likely to cause significant adverse environmental effects resulting from construction and operation.

1.3 Policy, Legal and Administrative Framework

1.3.1 National Requirements

The implementation of any activity in Armenia which may cause environmental impacts needs a positive conclusion of an EIA expertise. Environmental impacts of a planned physical activity or a sectoral/ regional development plan/ program have to be assessed during the preparation period. The **RA Law on Environmental Assessment and Expertise** of 2014 stipulates provisions regarding environmental impact assessment,

realization and terms, thus being the most important national law for carrying out the EIA. National Environmental Project approval from Ministry of Nature Protection has been given in July 2017 based on national EIA and geological reports. The national law requires an EIA, while the present draft report is about ESIA, as the Law on the Environmental Impact Assessment and Expertise does require coverage of social aspects of a proposed activity.

1.3.2 International Agreements

Armenia has ratified a number of international agreements and conventions relating to the protection of the environment and biodiversity as there are among others:

- The Convention on the Conservation of European Wildlife and Natural Habitats (Bern)
- Convention on Wetlands of International Importance (Ramsar)
- Conservation of Migratory Species of Wild Animals (Bonn)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington)
- European Landscape Convention (Florence)
- Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris)
- Framework Convention on Climate Change (Rio de Janeiro)
- Convention on Biological Diversity (Rio de Janeiro).

With respect to handling of hazardous substances, the Government of the Republic of Armenia ratified the Stockholm Convention and is a party of the Basel Convention. In addition, an important, environmentally relevant international agreement to which Armenia is a signatory is the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters.

1.3.3 International Requirements

According to ADB's Safeguard Policy Statement (2009) and IFC's Sustainability Framework (2012) the Project falls into environmental **Category A**, thus requiring preparation of an ESIA study. ADB and IFC define that ESIAs shall be conducted in line with national laws and regulations as well as in line with international environmental and social safeguard standards From the policies, the following are highlighted as of importance for the present ESIA:

- IFC Performance Standards on Social and Environmental Sustainability (IFC, 2012)
- IFC/ WB Environmental, Health and Safety (EHS) Guidelines
- ADB Safeguard Policy Statement (SPS, 2009).

The specific IFC/World Bank Group guidelines applicable to this Project are the following:

- IFC/World Bank Group General EHS Guidelines (2007)
- IFC/World Bank Group EHS Guidelines for Electric Power Transmission and Distribution (2007)
- IFC/World Bank Group EHS Guidelines for Thermal Power Plants (2008)

The IFC Performance Standards (PS) triggered by the Project are given in the table below.

Table 1-1: IFC Performance Standards triggered by the Project

IFC PS	Name of PS	Triggered by the Project
PS 1	Assessment and Management of Environmental and Social Risks and Impacts	yes
PS 2	Labor and Working Conditions	yes
PS 3	Resource Efficiency and Pollution Prevention	yes
PS 4	Community Health, Safety, and Security	yes
PS 5	Land Acquisition and Involuntary Resettlement	no
PS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	yes
PS 7	Indigenous Peoples	no
PS 8	Cultural Heritage	(yes)

ADB's Safeguard Policy Statement (SPS) (2009) sets out the policy objectives, scope and triggers, and principles for three key safeguard areas: environmental safeguards (triggered by the Project), involuntary resettlement safeguards, and Indigenous Peoples safeguards.

Detailed guidance on environmental and social management of the Project, as well as on ESIA and ESMP preparation is provided in ADB's SPS, in Appendix 1. An EIA report includes the following major elements: (i) executive summary, (ii) description of the project, (iii) description of the environment (with comprehensive baseline data), (iv) anticipated environmental impacts and mitigation measures, (v) analysis of alternatives, (vi) environmental management plan(s), (vii) consultation and information disclosure, and (viii) conclusion and recommendations.

1.3.4 Gap Analysis regarding national and International Legislation

Comparing the current legislation of the Republic of Armenia (RA) with the IFC Performance Standards (2012), the concerning conventions stipulated by the International Labor Organization (ILO) and the related IFC/ WB EHS guidelines (2007) shows that nearly all IFC Performance Standards are covered by a range of National Laws, Government Decisions, Decrees and Orders.

1.4 Project Description

The new YCCPP-2 will consist of a gas turbine with generator (GTG), a Heat Recovery Steam Generator (HRSG), and a steam turbine with generator (STG) which will be installed in a new West East shaft centerline, and related auxiliaries.

The Gross Power output at Design Conditions and 'Base Load' operation mode of the combined cycle (GT Gross Power output + ST Gross Power output), is:

- Guaranteed Gross Power Output: 254 MW (at design conditions)
- Gross Heat Rate (based on LHV: 47,479 kJ/kg): 6,438 kJ/kWh
- Efficiency: 55.91%

The new power plant will be designed for full power generation mode, but will also be capable to run at partial load operation. The design life for YCCPP-2 is set to 20 years.

Interconnections to gas, water and electrical grid are already in place (the new CCPP will use interconnection of existing YCCPP-1). The new CCPP shall be connected with the facilities of the existing infrastructure provided below:

- Electricity: The new 220 kV substation is just under construction; the connection from the new power plant to the new substation will be via a new overhead transmission line or via a new underground cable; the distance between the new power plant and the new 220 kV substation is approx. 400 m
- New connection to the natural gas supply pipeline system, approx. 550 - 600 m
- New connection to the city water system (make-up water), approx. 1,000 m
- New connection to the water sewerage and discharge system, approx. 450 m / 100 m

The YCCPP-2 site is located at 929 masl (average) at the south eastern border of Shengavit, a highly industrialized district in the southern part of Yerevan. It is situated approx. 2 km southeast of Erebuni Airport, bordering Erebuni district and has many large industrial plants and factories in its vicinity. Despite their industrial character, Shengavit and Erebuni Districts are home to a high number of residents of Yerevan.

The following residential complexes are in the proximity of the site for YCCPP-2:

- the nearest residential area of Shengavit District (Noragavit village) is located approx. 1,350 m to the west
- Ayntap, a major village in the Ararat Province is located approx. 1,500 m to the south west

- Kharberd, another major village in the Ararat Province is located approx. 1,200 m to the south
- the nearest residential area of Erebuni District is located approx. 1,200 m to the north east.

The **Project Area** thus comprises the YCCPP-2 site and adjacent residential areas, as those might be impacted e.g. by air emissions during operation of the new power plant (see Figure 1-1).

Figure 1-1: Project Area located south of Yerevan, including nearest residential areas

For the construction of YCCPP-2 approx. 30 months are estimated. Thus, it is expected that the new power plant will be commissioned at the end of 2019/ beginning of 2020.

1.5 Analysis of Alternatives

The 'No Project' Scenario describes the situation without implementation of the Project. In this alternative, all environmental and social impacts of the Project would be avoided, but it would potentially have negative implications on the regional power supply; including implications for potential business opportunities.

The foreseen site location allows co-utilizing the existing auxiliary systems of YCCPP-1 such as water intake and discharge structures, fuel gas regulators, substations and devices. Possible alternative locations for the proposed new YCCPP-2 were considered prior to opting for the foreseen site. On account to minimize environmental impacts and additional costs for newly developing such a site and modifying the transmission network to

accommodate the new power plant, the foreseen site was selected together with MOE as a final option.

There are basically three different types of energy production: Renewable energy (mainly hydropower, wind, solar and geothermal power); Nuclear energy; and Thermal energy. The option of gas and steam combined cycle power plant was chosen, due to different constraints faced by the other alternatives for power production.

1.6 Description of the Environment (Baseline Data)

The baseline data collection for the Project Area focused on the subjects of protection: fauna and flora, soil, water, climate, air quality, noise, landscape, historical and cultural sites and socio-economic conditions (including health and safety).

The following documents have already been prepared for the Project:

- RENCO SPA: Armenia 250 MW CCGT Yerevan Capital City. Draft Feasibility Study [CCGT 250 MW – Yerevan /Armenia]
- Ecobarik-Audit LLC (2016): Report of Evaluation of Environmental Impact of the new Steam and Gas Combined Cycle Power Plant in Yerevan
- Geoterproject LTD (2016): Report on engineering-geological survey of Yerevan TPP new energy block area
- ArmPower CJSC (2017): Geological Report of Armhydroenergyproject CJSC
- Consecoard LLC (2017): Report on Monitoring Services

1.6.1 Environmental Conditions

The construction site is part of the Yerevan industrial area. The site itself and the surrounding land are poorly vegetated with much of the area having been disturbed by industrial developments. Detailed data about **flora and fauna** at the construction site do not exist, however, only sparse vegetation composed of grass, herbs and some bushes can be found at the construction site. The biodiversity value of the Project Area is assessed to be low.

No **Protected Areas** are located within or in the vicinity of the Project Area. This includes Important Bird and Biodiversity Areas (IBA) and Ramsar Sites.

In order to ensure the proper setting of YCCPP-2, two **geotechnical investigation programs** have been performed in 2016 and 2017 including topographic mapping, geophysical and engineering geological works, experimental borehole drilling, piezometer installation in some boreholes to measure the ground water level fluctuation, periodic measurement of water level and sample taking. The main outcomes of these studies include:

- In the study area underground waters have been detected in all the boreholes with 0.5-7.0 m depth and have seasonal fluctuation from 0.5 to 1.0 m. Detected underground waters have strong sulphate aggressiveness against ordinary concrete.
- There are no hazardous physical-geological phenomena and processes (landslides, rock slides, rockfall, erosion, suffosion, etc.) in the study areas.
- The study area is suitable for capital construction.

The geological studies which were performed at the construction site found mainly clayey **soils** which are in some places covered by fill up soils.

In August 2017 a monitoring study was performed regarding possible historic soil contamination at the construction site. The study concludes that soil quality is in line with the general characteristics of the region and is within the limits of national permitted norms.

The usage of the area for illegal disposal of different waste materials in the past has been reported. However during the site visit in July 2017 no asbestos-containing material or other hazardous waste was found, except of some empty oil drums. Near to these drums the topsoil was found to be contaminated by an oil leakage. Samples of the contaminated soil taken during the site visit in July 2017 were analyzed by a certified laboratory in Germany for content of PCBs. All PCB concentrations were below the detection limit of 0.2 ppm.

Regarding the Project Area, the nearest **water body**, Artashati Jrants Canal, is located 700 m south east of the construction site. No water from the canal will be used for YCCPP-2 and no water will be discharged to it. It is planned that YCCPP-2 will co-utilize the existing auxiliary systems of YCCPP-1 including water intake from grid and discharge structures leading to Hrazdan River.

According to the geological studies **underground waters** have been detected in all the boreholes with 0.5-7.0 m depth and have seasonal fluctuation from 0.5 to 1.0 m. A monitoring study was performed in August 2017 regarding groundwater quality at the construction site. YCCPP-2 is located in Hrazdan River basin management area. Water in the lower stream of Hrazdan River is classified as “bad” (5^{th} grade) according to Armenian water quality standards. The results of all water sampling tests were within the limits of the 5^{th} grade of water quality. Consequently, the possible groundwater drainage can be directed to the downstream area of Hrazdan River without additional cleaning.

In Yerevan the prevailing **climate** is a mountainous continental climate. It is characterized by hot and arid summers and rather cold winters; in a year there are on average a hundred days with minimum temperatures below freezing. The average temperature in Yerevan is 11.6°C. In summer (July and August) the average temperature exceeds 30°C. The coldest month is January at -4°C.Generally, there is little rainfall throughout the year;

precipitation averages 319 mm. The driest months are June to October with an average below 25 mm of rain. The wettest months are February, April and May with an average of 40 mm of rain.

On average, the most wind is seen in July. The strongest wind speed is observed in March and April (> 38 km/h). On average, the least wind is seen in September. The mean monthly wind speed over the year is 6.1 km/h. The wind mainly blows from NE, SSW and S.

The results of the air quality baseline monitoring show that the **airshed** surrounding the future YCCPP - 2 can be classified as **non-degraded** regarding the pollutants PM_{10}, SO_2 and NO_2.

The results of the noise baseline monitroing that some receptors in the area **are presently affected by noise levels that exceed the limits** due to the presence of industrial facilities and traffic.

The Project Area is located in a highly industrialized area in southern Yerevan. Here, the existing YCCPP-1, chemical plants, metal factories and other industrial infrastructure dominate the **landscape**.

1.6.2 Socio-Economic Conditions

The **population** in the Project Area can be differentiated into urban population of the districts of Shengavit (approx. 140,000 inhabitants) and Erebuni (approx. 117,000 inhabitants); and the village population of Ayntap (approx. 11,000 inhabitants) and Kharberd (approx. 17,000 inhabitants).

Sensitive receptors which might be affected by noise and air emissions during construction and operation of YCCPP-2 have been identified in the vicinity of the new power plant. These are people living in the adjacent residential areas in the Project Area and groupS of people living in illegal housings adjacent to the site.

Despite economic reforms and some recent growth, unemployment and poverty remain widespread in Armenia. Agriculture is the country's largest labor sector, followed by services and industry. The poorest Armenians are found in rural areas with the least favorable conditions for agricultural activities. There is a stark contrast between the city of Yerevan and the remote rural areas in terms of socio-economic opportunities.

The Project Area is part of a highly industrialized region of Yerevan. Only the area west of the foreseen construction site is used for pasture and/or agricultural purposes. The whole area of the construction site has already been acquired by ArmPower CJSC and local population does not **use the land** in any way.

As the history of human settlement in Armenia goes back to the Neolithic age and the area has since then been important as settlement, trade and

agricultural area, numerous historical and cultural sites exist. No known **historical or cultural sites** are located within the Project Area.

1.7 Environmental and Social Impact Assessment

Possible environmental and social impacts from the construction and operation of YCCPP-2 are analyzed. Potential impacts of the Project in relation to environmental and social receptors are characterized and the extent of impact (after implementation of mitigation measures) is assessed.

1.7.1 Environmental Impacts during Construction Phase

As the biodiversity value of the construction site is assessed to be low, there are only low impacts on **flora and fauna** expected during the construction phase. No **protected or sensitive areas** will be influenced by the Project.

The Project Area is not prone to soil erosion. **Soil** use is restricted to the area of the planned construction activities. Soil contamination during construction works can arise from improper waste disposal and accidental leakage from tanks of lubricants, solvents, paint, oil, diesel, chemicals, etc.

Surface water will not be influenced during the construction period. Contamination of the soil can indirectly lead to a pollution of the **groundwater**. During construction phase a temporary lowering of the groundwater level for 2-3 m is just under evaluation. If the groundwater level will be lowered, an additional impact assessment including the development of mitigation measures will be required such as communications to third parties, providing water supply alternatives in case of need, etc.

Dust generation from transportation and construction activities as well as emissions from vehicles and construction machinery will be the main impacts on **air quality** during the construction phase of the proposed Project.

Construction of the new power plant will add further highly visible structures (e.g. stacks and buildings) to the Project Area. Due to the already existing industrial infrastructure in the area, the construction of YCCPP-2 will not enhance the contrast between the industrial site and the surrounding areas significantly.

Possible impacts on soil and water can be prevented and mitigated by a professional handling and storage of hazardous substances and a proper handling of waste. The EPC Contractor shall develop a **Waste Management Plan** for the construction period containing among others the waste management hierarchy of avoidance, preparing for reuse, recycling as much as possible, recovery, and proper disposal of remaining waste. Hazardous waste shall be stored in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at THE new YCCPP-2 site, clearly

identified by labels, and Materials Safety Data Sheets (MSDS) shall be provided for each kind of hazardous waste. The final disposal of hazardous waste is subject to medium to long term national-level solutions to be decided upon and provided by the Government of RA.

1.7.2 Social Impacts during Construction Phase

During the construction period **local workforce** (mainly unskilled workers) from the nearby villages and Yerevan shall be employed for the construction works. This will contribute to much needed monetary income in the region. Special attention shall be laid on the recruitment of women, wherever possible. However, the income generation opportunity is not of long term duration, as it will be mostly limited to the construction period.

There is no **land use** by the local population at the construction site, as the area has already been acquired by ArmPower CJSC, fenced, and foreseen for construction of the YCCPP-2. No acquisition of further land will be necessary for this Project. There are no houses located inside the construction site, so that no physical relocation is foreseen.

Within the construction site and the Project Area no cultural or historic sites are known. For the case of an unexpected encounter of Cultural and Historical Sites or Goods, a **Chance Find Procedure** has to be implemented. In case of any chance finds, the construction has to be stopped immediately and the Agency of Protection of Historical and Cultural Monuments/ Ministry of Culture has to be informed to agree on further steps (as according to Armenian Law).

For construction of YCCPP-2 a site-specific Health, Safety and Environment Management Plan (**HSEMP**) will be developed by RENCO as EPC Contractor and a Health, Safety and Environment Management System (**HSEMS**) implemented during construction. An **H&S manager** of RENCO shall be on duty all the time during construction period. These HSEMP and HSEMS shall also be valid for any third parties or subcontractors in the supply chain.

Working personnel from abroad will be accommodated in RENCO's guesthouse or at hotels in Yerevan. Local workforce shall be employed from Yerevan and the adjacent villages. No workers' camps will have to be established as local workers will return to their home daily. Transfer to and from the construction site will be carried out by personnel private means or public transport, and in addition by means managed by the EPC Contractor.

Adequate security measures to prevent accidents and injury have to be taken when transporting construction equipment on trucks as this might be dangerous to residents, when trucks drive through residential areas or small villages. The construction site itself will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access to the site, thus also minimizing possible impacts on **community health & safety**.

The EPC Contractor shall develop an **Emergency Preparedness and Response Plan** for the construction period, and assist and collaborate with the potentially affected communities and local government agencies in their preparation to respond effectively to emergency situations.

Construction workers will wear ear protection devices as part of their Personal Protective Equipment (PPE), if they are exposed to **noise levels** higher than 80 dB (A), according to Armenian legislation. Residential areas in the vicinity of the site, which are located near to major roads, will be exposed to higher noise levels due to a greater volume of heavy truck traffic passing by on the main roads. Thus, truck movements shall only be allowed during daylight, but not between 7 pm and 6 am.

1.7.3 Environmental Impacts during Operation Phase

No sensitive **species** and no **protected areas** occur in the Project Area. Oily waste water flowing out of the new plant will be treated in an oil separator before discharging to Hrazdan River using the existing discharge system of YCCPP-1. HRSG blow down and other drainage will be neutralized at the chemical shop of the power plant to meet Armenian water quality standards and will then be discharged to the river. The utility sewerage will be connected to YCCPP-1 sewerage system. Thus, there will be only a low (if any) impact on aquatic organisms of Hrazdan River.

Soil contamination can be possible due to spillages from oil/ fuel/ paint/ chemicals used during operation of the power plant.

All **water** will be taken from the Yerevan potable water grid and will be used for all civil utilities like cooking, drinking, etc. It will also be used as process water which is connected to the raw water storage tank and for all other uses (e.g. cooling tower make up, HRSG blow-down tank quench, firewater tank and network, utility water network, etc.). A monthly monitoring program shall be established to be performed e.g. by "Environmental Monitoring and Information Center" SNCO in order to guarantee the adherence of all wastewater, sanitary water and drainage water to national/international limit values.

Contamination of the soil can indirectly lead to a pollution of the **groundwater**. An evaluation is currently ongoing regarding a possible lowering of the groundwater level for 2-3 m at the power plant's site permanently during operation by a drainage system. If groundwater level will be lowered, an additional impact assessment including the development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.

The indicative results of the ADC show that the national **air quality** standard for 24hr NO_2 may not be fulfilled in the area, when considering cumulative impacts. However, the applicable international standards are expected to be respected in all scenarios for all pollutants. Cooling towers'

particulate emissions shall be controlled through the use of drift eliminators, in order to have low drift phenomena.

The planned new power plant will add further highly visible structures (e.g. stacks and buildings). However, due to the already existing industrial infrastructure in the area, the realization of the project will not enhance the contrast between the industrial site and the surrounding areas.

Domestic **waste** produced by the plant staff shall be collected in provided bins and picked up by a contracted waste collector for disposal at Yerevan dumping site. All hazardous waste shall be stored in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at new YCCPP-2 site for future disposal. Materials Safety Data Sheets (MSDS) shall be provided for each kind of hazardous waste. The final disposal of hazardous waste is subject to medium to long term national-level solutions to be decided upon and provided by the Government of RA.

1.7.4 Social Impacts during Operation Phase

Power demand in Armenia is constantly rising due to rapidly growing economy and a rising population. Operation of YCCPP-2 with a guaranteed gross power output of 254 MW will improve the total output capacity of electric energy production and provide a more reliable power supply.

For operation of YCCPP-2 a site-specific Health, Safety and Environment Management Plan (**HSEMP**) will be developed by ArmPower as Operator and a Health, Safety and Environment Management System (**HSEMS**) implemented for operation. An **H&S manager** of ArmPower shall be on duty all the time.

The area of the new power plant will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access to YCCPP-2 site, thus also minimizing possible impacts on **community health & safety**. Security arrangements shall be guided by principles of proportionality, good international practice and Armenian law, and include training of security personnel regarding the use of force and conduct towards the community.

The operator shall develop an **Emergency Preparedness and Response Plan** for the construction period, and assist and collaborate with the potentially affected communities and local government agencies in their preparation to respond effectively to emergency situations.

Performance Guarantees for the new power plant provide **noise levels** which comply with IFC/ World Bank Group General EHS Guidelines for workers and for the public, as well as with national legislation. The calculation outcomes of the model for YCCPP-2 have shown that the operation of the new plant will not produce any significant increase of the noise pressure at the sensitive receptors.

During operation most **jobs** at YCCPP-2 will be for skilled workers like engineers which will require specific power plant training and will not be readily found in Armenia. A few simpler jobs (e.g. food supply, housekeeping, etc.) however, will also be available for people which shall be employed from the adjacent residential areas (if possible) in order to create some additional income.

1.7.5 Summary of Impacts

Assessment of environmental and social impacts, after implementation of the mitigation measures presented in the ESMP, is given in the following tables.

Table 1-2: Summary of impacts during construction phase

Impact of/on	Extent of Impact on/by
Fauna, Flora and Biodiversity	■
Protected Areas	o
Soil Use and Soil Erosion	■
Soil Contamination	■
Surface Water	o
Groundwater level lowering	■■ (still unknown)
Groundwater contamination	■
Climate and Air Quality	■
Landscape and Visual Aspects	■
Waste	■
Local Workforce	+
Land Usage and Ownership	o
Historical and Cultural Sites	■ (if any)
Occupational Health and Safety	■
Community Health and Safety	■
Noise	■

Extent of impact:

■■■	=	high
■■	=	medium
■	=	low
o	=	nil
+	=	locally positive
++	=	regionally positive

Table 1-3: Summary of impacts during operation phase

Impact of/on	Extent of Impact on/by
Fauna, Flora and Biodiversity	■
Protected Areas	o
Soil Contamination	■
Water Courses	■
Groundwater level lowering	■■ (still unknown)
Groundwater contamination	■
Climate and Air Quality	■
Landscape and Visual Aspects	■
Waste	■
Electricity Supply	++
Occupational Health and Safety	■
Community Health and Safety	■
Noise	■
Job opportunities	+

Extent of impact:

■■■	=	high
■■	=	medium
■	=	low
o	=	nil
+	=	locally positive
++	=	regionally positive

In conclusion, from the results of the impact assessment it can be seen that the environmental and social impacts will be low or medium, if all proposed mitigation measures of the ESMP are implemented. Positive impacts are related to creating of job opportunities especially during construction also for unskilled workers. The additional power generation will increase the total output of electric energy, providing a more reliable power supply countrywide.

1.8 Information Disclosure, Consultation, and Participation

During site visit in July 2017 FICHTNER's environmental and social specialists performed stakeholder meetings with mayors of the adjacent villages Kharberd and Ayntap, with the Heads of Departments of Erebuni and Shengavit Administrative Districts, with Environmental Monitoring and Information Center, with the Environmental Department of the Municipality of Yerevan, and with NGO Aarhus Center. Mayors of Kharberd and Ayntap had no concerns regarding the implementation of the Project. As both villages suffer under a high unemployment rate (> 70%) the mayors hope that the Project will create jobs for the local population. These statements have also been supported during the discussions with the Heads of Departments of Erebuni and Shengavit Administrative Districts.

The Final Draft ESIA, including the ESMP, will be disclosed to the public in English and Armenian versions. Interested people shall have real access to the documents, which shall therefore not only be posted on ArmPower's website, but shall also be delivered in printed copies to the local administration offices; advertisements in local media about their availability shall be made. Also Aarhus Center shall receive printed copies and ensure their sharing to representative civil society organizations. According to national Armenian requirements, the disclosure period is only 7 days, but disclosure of the documents for at least two weeks is recommended. After disclosure of the documents, public consultation meeting(s) on the Final Draft ESIA will be held. Consultation meeting(s) shall concentrate on interpreting the ESIA report to the stakeholders and seeking their feedback and concerns, which will then be considered in the revision of the Final Draft ESIA report.

A Draft SEP (Stakeholder Engagement Plan) providing further details is presented as an Annex to this ESIA Report.

1.9 Grievance Redress Mechanism

In the course of the construction process, **project affected people (PAP)** may feel treated unjustly, for which case ArmPower shall maintain a viable grievance redress mechanism. PAPs are encouraged to proceed in the following way:

a) Contact the contractor's designated grievance staff in the following way: in person via designated telephone number, via email, via regular mail. Alternatively, PAPs can contact their community leader, who would convey their grievance to the contractor's designated grievance staff.
b) Lodge complaint and provide information on the case. Each complaint will be registered and a tracking number will be assigned to it. Responses to all complaints should be provided within 15 days (or 25 days in cases where complaint resolution requires special efforts).
c) Agree with the contractor on mitigation measure.
d) Sign if the mitigation measure has been implemented as agreed
e) Seek redress from ArmPower if not satisfied with above mentioned procedure though designated telephone numbers, in person, or via email or regular mail. ArmPower should register all grievances and provide response within 15 days.
f) Seek redress from court if all else fails.

Nevertheless, the above mentioned grievance mechanism does not limit the citizen's right to submit the case straight to the court of law just in the first stage of grievance process. The grievance mechanism is designed to avoid lengthy court procedures.

The EPC Contractor RENCO and the future operator of YCCPP-2 ArmPower are requested to implement an independent grievance management system to enable the workers (and their organizations, where

they exist) to raise reasonable workplace concerns. This includes complaints related to non-compliance with Health & Safety matters, discrimination cases and non-consideration of equal opportunities. **The workers' grievance mechanism** shall follow the same principles as the one created for the general public: complaints must be answered in a timely and effective manner without fear of retribution; the access to the grievance mechanism shall not replace or impede the subsequent access to other redress mechanisms; the promoter will inform workers of the grievance mechanism at the time of hire and make it accessible to them.

1.10 Environmental and Social Management Plans (ESMPs)

The negative environmental and social impacts of the Project can be avoided, minimized or mitigated by performing suitable measures. The ESMPs deal with the concrete mitigation measures and the monitoring measures to be taken during the construction and operation phases of YCCPP-2. They summarize the anticipated environmental and social impacts and provide details on the measures, responsibilities to mitigate these impacts, the costs of mitigation, and the ways in which implementation and effectiveness of the measures will be monitored and supervised.

1.10.1 Mitigation Measures for the Construction Phase

The main possible impacts during construction period will be contamination of soil and water, impacts on health and safety of workers and the public, as well as possible lowering of the groundwater level at the construction site.

Contamination of soil and groundwater can be avoided e.g. by regular maintenance of all vehicles and machines at regular service stations, maintenance and re-fueling of the construction equipment only on sealed and enclosed areas, providing spill control material and training of workers regarding handling of oil, fuel, etc. and how to avoid and clean up spills.

Construction site has to be equipped with toilets and sanitary rooms separately for men and women. Sewage water shall be led to the sewage water system of adjacent YCCPP-1 or septic tanks for collecting sewage water have to be used, which have to be emptied by a specialized company from time to time.

A groundwater study for the construction site is currently under preparation evaluating the possible lowering of the groundwater level for 2-3 m at the construction site during construction period, or permanently by a drainage system. If groundwater level will be lowered, an additional impact assessment including the development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.

The EPC Contractor shall develop a site-specific Health, Safety and Environment Management Plan (HSEMP) and implement a Health, Safety and Environment Management System (HSEMS) for construction phase. An H&S manager of EPC Contractor shall be on duty all the time during construction period. The HSEMP shall also include a Waste Management Plan as well as an Emergency Preparedness and Response Plan.

1.10.2 Mitigation Measures for the Operation Phase

The main possible impacts during the Operation Phase will be the air and noise emissions as well as effluents from the new power plant, and the possible permanent lowering of the groundwater level.

The stack of the new power plant will be equipped with Continuous Emissions Monitoring System (CEMS). The foreseen emissions are below the relevant national and international limit values. Compliance of air emissions to Performance Guarantees of ArmPower, national Armenian and IFC/ World Bank limits for air emissions shall be monitored e.g. by "Environmental Monitoring and Information Center" SNCO.

Oily waste water from power plant operation will be collected and routed to a treatment plant (oil separator) before being discharged to recipient existing system of YCCPP-1. Rain water which may be potentially oily will be routed to the same system; other rain water collected from the paved areas will be disposed to the existing discharge system leading to Hrazdan River.

HRSG blow down and other drainage from steam/water system will be neutralized at the chemical shop of the power plant to meet relevant water quality standards and will then be discharged using the existing discharge system. The utility sewerage will be connected to the already existing YCCPP-1 sewerage system. A monthly monitoring program shall be established to be performed e.g. by "Environmental Monitoring and Information Center" SNCO in order to guarantee the adherence of all wastewater, sanitary water and drainage water to Performance Guarantees of ArmPower, national Armenian and IFC/ World Bank limits.

A groundwater study for the power plant’s site is currently under preparation evaluating the possible lowering of the groundwater level for 2-3 m permanently site by a drainage system. If groundwater level will be lowered, an additional impact assessment including the development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.

ArmPower as operator of the new power plant will have to develop and implement an Emergency Preparedness and Response Plan as part of its site-specific Health, Safety and Environment Management Plan (HSEMP).

1.10.3 Implementation Arrangements and Capacity Building

RENCO SPA as EPC Contractor has to implement the ESMP within its own site-specific Health, Safety and Environment Management System (HSEMS) in a proper way and shall have an HSE manager on duty throughout the construction period. This HSE officer shall prepare monthly reports of all HSE relevant incidents and accidents and send these reports to the Health, Safety and Environment Manager of ArmPower and the relevant national authorities as well as to the external internationally experienced auditor.

An external internationally experienced auditor shall perform quarterly supervision of the implementation of the ESMP and monitor the implementation of the mitigation measures. The aim of the audits will be to ensure that all mitigation measures are implemented adequately. In case of any discrepancies, the specialist shall implement proper actions to establish compliance with the ESMP. If this is not possible and if the discrepancy is considered to be severe, the person(s) in charge shall be empowered to stop the work immediately until compliance is achieved again. Based on his quarterly supervision and the monthly reports provided by the Health, Safety and Environment Manager of RENCO, the external auditor will produce narrative analytical quarterly reports on environmental and social performance in the course of the Project and furnish these reports to ADB/ IFC and to ArmPower.

Measures for capacity building at "Environmental Monitoring and Information Center SNCO" shall be considered. These measures should include employment of additional staff or contracting outside resources for monitoring purposes (or both). Existing staff shall be trained in effective monitoring procedures including knowledge about national and international (ADB, IFC/World Bank) guidelines and limit values.

1.10.4 Summary of Costs for Implementation of the EMSP

A total cost of **171,500 USD** is foreseen for implementation of the ESMP. This value includes monitoring of air quality and noise during construction and/or commissioning, as well as a quarterly supervision of construction sites to be performed by an internationally experienced auditor. Expenses for other measures are included in the regular construction/operational works.

1.10.5 Gap Analysis regarding compliance with IFC Performance Standards

After implementation of the mitigation measures, the Project complies with the requirements of all IFC Performance Standards applicable.

1.10.6 Environmental and Social Action Plan

An Environmental and Social Action Plan (ESAP) is presented in order to highlight the most urgent steps for implementation of the mitigation measures given in the ESMP, according to the relevant IFC Performance Standards and/or international guidelines and standards.

1.11 Overall Findings, Conclusion and Recommendations

The main possible impacts of the Project will be contamination of soil and water, impacts on health and safety of workers and the public, possible lowering of the groundwater level (still to be investigated) at the construction/power plant site, air and noise emissions and liquid effluents from the new power plant.

Negative environmental and social impacts of the Project will be **low or medium**, if all proposed mitigation measures of the ESMP are implemented. There will be no severe social impacts from the Project; no land acquisition nor resettlement will be necessary. Regular **monitoring of noise and air emissions as well as effluents** during construction and /or operation phase shall be performed, in order to guarantee adherence to relevant national and/or international limit values.

Positive impacts are related to creating job opportunities, especially during construction. The additional power generation will increase the total output of electric energy, providing a more reliable power supply countrywide.

If a lowering of the groundwater level at the construction/ plant site will be performed, an additional impact assessment including development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.

In summary, it can be concluded that the proposed Project of Yerevan Steam and Gas Combined Cycle Power Plant (YCCPP-2) **can be implemented without having significant adverse impacts on the ecological and social environment**, if all mitigation measures proposed in the ESMPs are implemented.

2. Introduction

2.1 Project Background

The Ministry of Energy (MOE) of the Republic of Armenia plans to improve the total output capacity of its electric energy production, complementing the power units of the existing Yerevan Combined Cycle Power Plant (YCCPP-1) with a most modern and efficient power plant. For this reason a new gas fired Combined Cycle Power Plant of 254 MW (YCCPP-2, or "the Project") is planned to be built at the site next to the existing YCCPP-1 (see Figure 2-1) in an already industrialized region in the south of Yerevan. The implementation of the Project is urgent in consideration of the closure of the Metsamor Nuclear Power Plant that will strongly reduce the capacity of electric energy production for the next years (US AID, 2010).

Figure 2-1: Site location (red) of the planned YCCPP-2 (black), next to the existing YCCPP-1

The foreseen site location allows co-utilizing the existing auxiliary systems of YCCPP-1 such as water intake and discharge structures, fuel gas regulators, adjacent substation and devices. Possible alternative locations for the proposed new YCCPP-2 had been considered prior to opting for the foreseen site. On account to minimize the additional costs for newly developing such a site and modifying the transmission network to accommodate the new power plant, the foreseen site was selected together with MOE as a final option.

As the energy sector development has a critical impact on the economic development of the entire country, the Government of Armenia considers this project to be of outmost significance with the highest priority for execution (fast-track project).

The following documents have already been prepared for the Project:

- RENCO SPA: Armenia 250 MW CCGT Yerevan Capital City. Draft Feasibility Study [CCGT 250 MW – Yerevan /Armenia]
- Ecobarik-Audit LLC (2016): Report of Evaluation of Environmental Impact of the new Steam and Gas Combined Cycle Power Plant in Yerevan
- Geoterproject LTD (2016): Report on engineering-geological survey of Yerevan TPP new energy block area

These documents have been the basis for issuance of the national environmental approval to the planned Project, which is documented in the following Conclusion: "RA Minister of Nature Protection (11.01.2017): State Expert Examination Conclusion on Expert Examination of Influence on the Environment BP 02. Report of evaluation of influence on environment of the new power station in Yerevan with combined cycle of steam and gas".

2.2 Objective of the Project

Along with a rapidly growing economy and a rising population, power demand in Armenia is constantly increasing. The main objective of the construction of the 254 MW Combined Cycle Power Plant (YCCPP-2) is to:

- Improve the total output capacity of electric energy production;
- Provide reliable power supply;
- Shift the financial burden for power generation from the government to the private sector;
- Promote commercial development of thermal technology and cost reduction that enables Armenia to become a major net exporter of electricity; and
- Build and sustain local capacity in the development and maintenance of power generation infrastructure.

The new CCPP will include a Gas Turbine (GT), a Steam Turbine (ST), a Heat Recovery Steam Generator (HRSG) and all auxiliary equipment and systems that, at local conditions with an ambient temperature of 15°C, will produce 254 MW electrical output.

Interconnections to gas, water and electrical grid are already in place (the new CCPP will use the interconnection of the existing YCCPP-1). The new CCPP shall be connected with the facilities of the existing infrastructure provided below:

- Electricity: A new 220 kV substation is under construction; the connection from the new power plant to the new substation will be via a new overhead transmission line or via a new underground cable; the distance between the new power plant and the new 220 kV substation is approx. 400 m.

- New connection to the natural gas supply pipeline system, approx. 550 - 600 m.
- New connection to the city water system (make-up water), approx. 1,000 m.
- New connection to the water sewerage and discharge system, approx. 450 m / 100 m.

2.3 Objectives and Methodology of the ESIA

2.3.1 Scope and Objectives of the ESIA

The overall aim of the ESIA is to give an overview of the present situation in the area of the Project implementation and its vicinity ("the Project Area"), to assess the potential (positive and negative) impacts of the Project and to name appropriate mitigation measures and monitoring approaches. This shall be for the benefit of the plant owner, the concerned public and the future donor bank of the Project.

The main objectives of the ESIA Study are to:

(i) explain the Project framework including the current design and key technical aspects;
(ii) analyze the environmental and social baseline in the Project area and the resulting requirements for impact assessment in compliance with all relevant international policies (e.g. ADB's Safeguard Policy Statement, IFC/World Bank EHS Guidelines, EU EIA Guideline) as well as Armenian national environmental guidelines and requirements;
(iii) perform a detailed environmental and social impact assessment on the basis of the technical design, available data and field surveys with the purpose of understanding the current environmental and social situation in the Project area and to assess the potential positive and negative impacts of the Project;
(iv) identify and recommend measures to avoid, minimize or mitigate adverse environmental and social impacts of the Project during the construction and operation phases, and recommend referring monitoring measures to be addressed during Project implementation through the preparation of an ESMP (Environmental and Social Management Plan).

On the basis of the existing environmental situation and the technical planning FICHTNER determined and evaluated the environmental and social impacts during construction and operation of the planned YCCPP-2. The impact assessment focused on the ecological aspects of the Project and on the effects for the local population. In a second step, appropriate mitigation measures and monitoring measures were considered to reduce possible adverse impacts.

After public disclosure of the ESIA, including the ESMP, public consultations will be executed in order to seek feedback and concerns of stakeholders and people possibly affected by the Project (see also Draft Stakeholder Engagement Plan in Section 13.6 in the Annexes).

2.3.2 Procedures and Methodology

A general overview about the Project site's biophysical settings has been done as a desktop study, including a review of existing studies about the Project [1, 2, 3,4]. A field survey was conducted by FICHTNER's environmental and social experts in July 2017, including visiting the proposed CCPP site. In July and August 2017 further surveys (air and noise baseline monitoring) have been undertaken.

The environmental and social impacts of the Project are predicted in relation to the environmental and social receptors (fauna and flora, land use, residents of villages, etc.) and natural resources. This is accomplished by comparing the baseline conditions with situations ensuing when the Project is implemented. Additional information was gained by consultations of representatives of governmental organizations (e.g. Yerevan Municipality, Environmental Monitoring and Information Center at the Ministry of Nature Protection) and non-governmental organizations (NGOs) (e.g. Aarhus Centers of Armenia).

To obtain up-to-date data about the ground level concentrations (GLC) of air pollutants in the Project Area, and help defining the airshed as degraded or non-degraded (according to the WB EHS Guidelines), FICHTNER undertook an air quality monitoring campaign including the measurement of SO_2, NO_2 and PM_{10}. These data have been used as an input for an Air Dispersion Calculation. This monitoring campaign will be repeated in next autumn, winter and spring in order to cover all seasons of an annual cycle. The results will be used as an input for an updated Air Dispersion Calculation report.

To obtain data about the existing noise levels in the Project Area, FICHTNER undertook a noise monitoring campaign in an area around the YCCPP-2 site at five monitoring points. The results were used as an input for a Noise Propagation Study report.

Due to the fact that there is no official international consensus on an agreed approach for assessing the significance of impacts on the environment, FICHTNER uses an own evaluation procedure. This transparent evaluation

[1] RENCO SPA: Armenia 250 MW CCGT Yerevan Capital City. Draft Feasibility Study [CCGT 250 MW – Yerevan /Armenia]
[2] Ecobarik-Audit LLC (2016): Report of Evaluation of Environmental Impact of the new Steam and Gas Combined Cycle Power Plant in Yerevan
[3] Geoterproject LTD (2016): Report on engineering-geological survey of Yerevan TPP new energy block area
[4] Armpower CJSC (2017): Geological Report of Armhydroenergyproject CJSC

procedure is based upon FICHTNER's extensive experience over the last fifteen years in performing Environmental and Social Impact Assessments and has proven to be a reliable method for assessing a project's impacts on the environment. It includes identification, prediction and evaluation of the significance of impacts based on legal requirements. Wherever possible, impacts are quantified. The focus of the used evaluation procedure is to decide whether the Project is likely to cause significant adverse environmental effects resulting from construction and operation.

For the purpose of a transparent presentation and evaluation, a tabulated evaluation matrix is applied. On the basis of a point scale, the severity of the particular environmental or social impact together with its general trend - that is, negative or positive - is described. The following evaluation scale is applied:

Extent of impact:

■■■	=	high negative
■■	=	medium negative
■	=	low negative
	=	nil
+	=	locally positive
+ +	=	regionally positive

As a basis for the evaluation, the sensitivity of the relevant subject of protection and the impact magnitude are estimated. For final judgment of the extent of impact, international standards like standards from the World Bank, World Health Organization (WHO), etc. are used (see Section 3.3), supported by Armenian standards (see Section 3.1). According to these standards, the evaluation of impacts is done as follows (Table 2-1):

Table 2-1: Evaluation of impacts using International and National Standards

Extent of impact	Reason
High	International and national standards are exceeded
Medium	Between international and national standards, international and national standards are barely met
Low	International and national standards are met

3. Policy, Legal and Administrative Framework

This Chapter presents the policy, legal and administrative framework for environmental and social management in the Republic of Armenia (RA), with particular reference to the provisions for conducting an ESIA. The Project will conform to applicable local/ national and international environmental and social legislation, regulations and guidelines as well as specific procedures and policies of State Authorities, the Asian Development Bank (ADB) and the International Financing Cooperation (IFC), and other available best practices. These require that an ESIA of the designed works is carried out, and the ESIA report reviewed and approved in the light of prevailing environmental and social policies and regulations.

3.1 National Requirements

Following independence in 1991, the environmental legislation was reviewed with the aim of developing a more comprehensive state policy towards ecological protection and sustainable use of resources. To this end, a series of laws have been developed, including regulations relating to protected areas, a land code (both 1991) and a forest statute (1994). From 1999 to today, a number of national laws of RA were implemented to regulate the protection of the environment. Key laws/ regulations related to the Project are given in Table 3-1 below.

Table 3-1: National laws of RA, implemented to regulate the protection of the environment and expropriation issues

Law/ Policy	Year	Main scopes
Decree of RA Supreme Council on Adoption of Fundamentals of the Nature Protection Legislation of RA	1991	RA nature protection policy is envisaged by fundamentals. Fundamentals are dedicated to maintain protection and using arrangement of the natural environment in the territory of Armenia as well as creation of the necessary legal basis to develop nature protection legislation to regulate relationships regarding mining; use and protection of forest and water, flora and fauna, atmospheric air protection.
RA Law on Protection of Atmospheric Air	1994	Subjects of that law are prevention and elimination of atmospheric air pollution and realization of international cooperation within protection of atmospheric air. The main legislative issues in this domain are: - maintenance of improvement of purity and quality of atmospheric air - prevention and reduction of chemical, physical, biological and other influences over atmospheric

Law/ Policy	Year	Main scopes
		air conditions - regulation of public relationships within that sphere - strengthening of legality within that sphere.
RA Law on Environmental Protection and Environmental Usage Fees	1998	That law provides definition of environmental protection and environmental usage fees, scope of payers, types of fees, calculation and payment rules, and liabilities against breach of that law as well regulates other relationships on fee payments. Types of environmental protection fees are payments: - against emission of hazardous substances at environment (air and water basin) - for industrial waste and household refuse disposal within adopted regulation - against environmentally harmful products. Types of environmental usage fees are payments: - for water use - for resources of extracted minerals, - for bio-resources use.
RA Law on Conservation and Use of Historical and Cultural Monuments and Historic Environment	1998	The subjects of that law are: - provision of legal basis within domain of protection and use of monuments and - regulation of relationships, which are begotten within those activities. - The main issues of that law are: - envisaging of general provisions of the state policy within domain of protection and use of monuments - envisaging of regulation principals of recording, conservation, research, restoration, repair, restoration and use of monuments - envisaging of authorities of the state governmental and local self-governmental bodies, legal entities and natural persons within domain of protection and use of monuments - envisaging of special features of ownership rights to possess, use and dispose monuments, which are specific type of real estate.
RA Law on Flora	1999	Law on flora provides RA state policy regarding approved science-based protection, conservation, use and reproduction of natural flora.
RA Law on Fauna	1999	That law provides RA state policy

Law/ Policy	Year	Main scopes
		regarding conservation, protection, reproduction and use of species of wild fauna. The subjects of that law are: - conservation, protection, natural reproduction of genetic and species diversity - prevention of infringement of comprehensiveness of animals' living environment - protection of comprehensiveness of animal species, their populations and relatives - protection of animals migration routes - regulation of relationships regarding using of objects of fauna. Responsibilities of different organizations, including government, ministries, state bodies, local self-governmental bodies are envisaged by that law.
RA Land Code	2001	That Code provides legal basis of land relationships (regarding improvement of the state regulation, development of the land management in various organizational-legal forms, soil fertility, increment of the efficiency of land use, protection and improvement of favorable environment for human life and health, protection of rights to land) by taking into consideration significant environmental, economic and social essence of land, due to which the land is used and maintained as a condition of life for population in RA. According to the Code, possession, using and disposal of land must not damage the environment, security and defensibility of the state as well as must not violate rights and interests of citizens and other persons that are protected by the law.
RA Water Code	2002	By this legal act, the relationships regarding using of water are mainly regulated. Article 3 of the Code envisages that RA Government through appropriate state authorized bodies realizes purposes of the code, maintain water saving, protection from harmful influence, using of water for public interests aimed at conserving security of each person. Vital principals of water resources management are: - satisfaction of main vital needs of

Law/ Policy	Year	Main scopes
		present and future generations - maintenance and increase of the volume of the national water resources - protection of water and related ecosystems and their biological diversity - recognition of complete and coherent relationship of land, air, water and biological diversity - regulation of water use through water use permission.
RA Law on Waste	2004	This law shall regulate relations on waste collection, transportation, storage, processing, recycling, removal, volume reduction and other relations regarding the before mentioned activities, as well as legal and economical bases for prevention of adverse effects of waste on human health and environment.
RA Law on Environmental Assessment and Expertise	21 June 2014	This law regulates environmental impact assessment (through legal, economic and organizational principles) of proposed activities and concepts.

The implementation of any activity in Armenia which may cause environmental impacts needs a positive conclusion of an EIA expertise. Environmental impacts of a planned physical activity or a sectoral/ regional development plan/ program have to be assessed during the preparation period. The **RA Law on Environmental Assessment and Expertise** of 2014 stipulates provisions regarding environmental impact assessment, realization and terms, thus being the most important national law for carrying out the EIA.

In the RA Law on Environmental Assessment and Expertise "*Thermo power plants, heat and hot water producing plants*" are listed requiring an EIA process. According to ADB's Safeguard Policy Statement (2009) and IFC's Sustainability Framework (2012) the Project falls into environmental **Category A**, thus requiring an ESIA.

Consequent steps for obtaining environmental approval, as set forth in the national legislation, are given below:

1) Preliminary stage: During this stage preliminary information regarding the project (activity) is presented to the head(s) of the affected community(ies), and public hearings are organized by the project proponent jointly with the head(s) of community(ies). The general information about the project and the notice should be published on the websites of the project owner and the affected community(ies) or other public media 7 days prior to the date of the public hearing. According to the Draft Government Decree on organization of public hearings the

notice should be published on the web sites not less than 7 days prior, and the project information not less than 3 days before.

2) An application is then to be submitted to the Ministry of Nature Protection (not to the *Nature Protection Expertise* SNCO directly). This request includes general description of the project, measures for mitigation/ compensation and the results of a first public hearing organized by the community(ies) head(s) and the project owner.

3) Within 30 days the Ministry of Nature Protection, 1) makes a decision about the a necessity of state environmental expertise, 2) provides an impact category to the project (e.g. a thermal power plant = Cat A), 3) provides a list of activities, and volume and depth of the works for the development of an Environmental Impact Assessment Report (provides the ToRs for the EIA). Within this period, the execution of a second public hearing is needed to be jointly performed by project proponent, head(s) of affected municipality(ies) and the Ministry of Nature Protection. The same rules for dissemination as for the first public hearing shall be applied.

4) The Project proponent prepares the draft EIA Report and submits it to the Ministry of Nature Protection.

5) The next stage is the main stage of the environmental expertise. During this stage, which lasts 40 days for Projects of Category B and 60 days for those of Category A, the Ministry of Nature Protection submits the draft EIA report to all involved and specialized parties (e.g. to its departments, to the relevant departments of Academy of Science, the Ministry of Healthcare, the Ministry of Emergency Situations, State Committee for Water Resources, etc.) as an internal procedure of the Ministry. The Project proponent is not involved in this. During this stage the Project proponent, jointly with the head(s) of community(ies) and the Ministry, organizes the 3rd public hearing, during which the whole draft EIA report is introduced to the general public. The Ministry provides all the comments and recommendations of all parties involved in the revision of the draft EIA, as well as main comments and recommendations which were arisen during the 3rd public hearing. The Project proponent either makes amendments to the draft or justifies the rejection of amendments.

6) At the end, the Ministry organizes the final public hearing, during which it represents all the comments and recommendations provided, the results of these comments and recommendations (if the proposed changes were adopted or not), and gives an opinion on the EIA report (approval or rejection).

7) Based on this, the Ministry provides the final approval or rejection of the project, signed by the Minister. Steps 5-7 are included in the total duration (40 days for Category B and 60 days for Category A).

The above procedure is generally consistent with ADB's and IFC's environmental safeguard policies. The national law requires an EIA, at the same time that it requires coverage of the social aspects of a proposed activity. This is included in this report, which is denominated ESIA and not EIA for this motive. . ADB's and IFC's policies require that once a draft ESIA report is disclosed, sufficient time is allowed for stakeholders to get acquainted with the document prior to participating in a consultation meeting or otherwise communicating their feedback. According to ADB's Safeguard Policy Statement (2009) and ADB's Public Communication Policy (2011), a draft EIA report for a category A project shall be publicly disclosed for at least 120 days on ADB's website before Board consideration. IFC's Sustainability Framework (IFC 2012) requires a disclosure of 60 days for a category A project.

3.2 International Agreements

Armenia has ratified a number of international agreements and conventions relating to the protection of the environment and biodiversity, including_ :

- The Convention on the Conservation of European Wildlife and Natural Habitats (Bern)
- Convention on Wetlands of International Importance (Ramsar)
- Conservation of Migratory Species of Wild Animals (Bonn)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington)
- European Landscape Convention (Florence)
- Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris)
- Framework Convention on Climate Change (Rio de Janeiro)
- Convention on Biological Diversity (Rio de Janeiro).

With special respect to handling of hazardous substances:

- Stockholm Convention "On Persistent Organic Pollutants" (ratified by the Government of the Republic of Armenia 2003)
- Basel Convention "On the Control of Transboundary Movements of Hazardous Wastes and their Disposal" (being a party since 1999).

In addition Armenia is a signatory to the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.

3.3 International Requirements

ADB and IFC define that ESIAs shall be conducted in line with national laws and regulations as well as in line with international environmental and social safeguard standards. To this end, projects financed by these institutions must meet the respective environmental, social and disclosure policies. From the policies, the following are highlighted as of importance for the present ESIA:

- IFC Performance Standards on Social and Environmental Sustainability (IFC, 2012)
- IFC/ WB Environmental, Health and Safety (EHS) Guidelines
- ADB Safeguard Policy Statement (SPS, 2009).

In sectors where no appropriate IFC/ADB policies or guidelines exist, the banks apply relevant internationally recognized standards (for example, those of the US EPA or the EU Directives).

3.3.1 IFC Performance Standards (PS)

IFC adopted eight Performance Standards on Social and Environmental Sustainability (IFC, 2012) in order to manage social and environmental risks and impacts and to enhance development opportunities.

Performance Standard 1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project.

Performance Standards 2 to 8 establish objectives and requirements to avoid, minimize, and where residual impacts remain, to compensate/ offset for risks and impacts to workers, affected communities, and the environment. While all relevant environmental and social risks and potential impacts should be considered as part of the assessment, Performance Standards 2 to 8 describe potential environmental and social risks and impacts that require particular attention. Where environmental or social risks and impacts are identified, the client is required to manage them through its Environmental and Social Management System (ESMS) consistent with Performance Standard 1.

A number of cross-cutting topics such as climate change, gender, human rights, and water, are addressed across multiple Performance Standards.

IFC PS 1: Assessment and Management of Environmental and Social Risks and Impacts

Performance Standard PS 1 **applies to all projects** that have environmental and social risks and impacts. It underscores the importance of managing environmental and social performance throughout the life of a project.
Its objectives are:

- To identify and evaluate environmental and social risks and impacts of the project.
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/ offset for risks and impacts to workers, affected communities, and the environment.
- To promote improved environmental and social performance of clients through the effective use of management systems.
- To ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately.
- To promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

IFC PS 2: Labor and Working Conditions

Performance Standard PS 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. The requirements set out in PS 2 have been in part guided by a number of international conventions and instruments, including those of the International Labour Organization (ILO) and the United Nations (UN).

Its objectives are:

To promote the fair treatment, non-discrimination, and equal opportunity of workers.
To establish, maintain and improve the worker-management relationship.
To promote compliance with national employment and labor laws.
To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
To promote safe and healthy working conditions, and the health of workers.
To avoid the use of forced labor.

Workers will be employed especially during the construction phase of the Project, thus **triggering this Performance Standard**.

IFC PS 3: Resource Efficiency and Pollution Prevention

Performance Standard PS 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. PS 3 outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. In addition, it promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a project that relies on commercially available skills and resources.

Its objectives are:

To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
To promote more sustainable use of resources, including energy and water.
To reduce Project-related GHG emissions.

As the new Combined Cycle Power Plant will have emissions to the air from burning gas for power generation and as certain amounts of waste water and different types of waste will be produced during construction and operation of the plant, **this Performance Standard is triggered**.

IFC PS 4: Community Health, Safety, and Security

Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, PS 4 addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.

Its objectives are:

To anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances.
To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities.

Community health, safety and security **will be a topic during all phases of the Project**.

IFC PS 5: Land Acquisition and Involuntary Resettlement

Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/ or restrictions on land use.

Its objectives are:

To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.
To avoid forced eviction.
To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
To improve, or restore, the livelihoods and standards of living of displaced persons
To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

This **Performance Standard will not be triggered by the Project**, as all land necessary for the construction and operation of YCCPP-2 has already been acquired. Existing access roads will be used and no physical relocation will be necessary for implementation of the Project.

IFC PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in PS 6 have been guided by the Convention on Biological Diversity.

Its objectives are:

To protect and conserve biodiversity.
To maintain the benefits from ecosystem services.
To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Due to air emissions from the planned power plant as well as due to the production of waste water and wastes during construction and operation, this Performance Standard is **triggered by the Project**.

IFC PS 7: Indigenous Peoples

Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development.

Its objectives are:

To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples.
To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts.
To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.
To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle.
To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present.
To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.

This **Performance Standard will not be triggered by the Project** as no groups of Indigenous People are living in the Project Area.

IFC PS 8: Cultural Heritage

Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, PS 8 aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this PS on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

Its objectives are:

To protect cultural heritage from the adverse impacts of project activities and support its preservation.
To promote the equitable sharing of benefits from the use of cultural heritage.

There is no cultural heritage known to be located in the Project Area. Thus, this Performance Standard would only be **triggered** if any unexpected cultural or archeological goods were found during construction.

3.3.2 IFC/ World Bank EHS Guidelines

The IFC/ WB Environmental, Health and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The General EHS Guidelines contain a series of specific guidelines for different projects. They are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent.

The specific guidelines applicable to this Project are the following:

- IFC/World Bank Group General EHS Guidelines (2007)
- IFC/World Bank Group EHS Guidelines for Electric Power Transmission and Distribution (2007)
- IFC/World Bank Group EHS Guidelines for Thermal Power Plants (2008)

3.3.3 ADB Safeguard Policy Statement

The ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, financial intermediation loans, and private sector investment operations. Environmental assessment is a process rather than a one-time report, and includes necessary environmental analyses and environmental management planning that take place throughout the project cycle.

The objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and

- help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

ADB's SPS (2009) sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

- environmental safeguards,
- involuntary resettlement safeguards, and
- Indigenous Peoples safeguards.

ADB staff, through their due diligence, review, and supervision, will ensure that borrowers/clients comply with safeguard requirements during project preparation and implementation. These safeguard requirements are as follows:

- Safeguard Requirements 1: Environment,
- Safeguard Requirements 2: Involuntary Resettlement,
- Safeguard Requirements 3: Indigenous Peoples, and
- Safeguard Requirements 4: Special Requirements for Different Finance Modalities.

ADB uses a classification system to reflect the significance of a project's potential impacts through three types of impacts of the proposed projects: environmental impacts, probable involuntary resettlement and potential impacts on Indigenous Peoples.

- Category A. A proposed project is classified as category A if it is likely to have significant involuntary resettlement impacts, significant impacts on Indigenous Peoples and/or significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), an Indigenous Peoples plan (IPP), including assessment of social impacts and a resettlement plan, including assessment of social impacts is required.
- Category B. A proposed project is classified as category B if it includes involuntary resettlement impacts that are not deemed significant, if it is likely to have limited impacts on Indigenous Peoples, and/or if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, a resettlement plan, including assessment of social impacts and an IPP, including assessment of social impacts, is required.
- Category C. A proposed project is classified as category C if it has no involuntary resettlement impacts, if it is not expected to have impacts on Indigenous Peoples, and if it is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

- Category FI. A proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary.

A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, induced, and cumulative impacts, its most sensitive component in terms of involuntary resettlement impacts and its most sensitive component in terms of impacts on Indigenous Peoples.

The Project subject to this ESIA is classified as of **Category A** due to its likelihood of causing significant adverse environmental impacts that are irreversible, diverse, or unprecedented. No resettlement impacts nor impacts on Indigenous Peoples are expected. An ESMP is included in Section 10.6.

Detailed guidance on environmental and social management of the Project, as well as on ESIA and ESMP preparation is provided in ADB's SPS, in Appendix 1. As a summary, the following items are of importance for the Project and are included in this report:

- Analysis of alternatives;
- Appropriate environmental and social baseline data;
- All potential impacts and risks of the project on physical, biological, socioeconomic (occupational health and safety, community health and safety, vulnerable groups and gender issues, and impacts on livelihoods through environmental media) and physical cultural resources in an integrated way and in the context of the project's area of influence;
- Preparation of an environmental management plan (EMP) including:
- proposed mitigation and compensation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators;
- Principles to monitor and measure the progress of implementation of the EMP;
- Information Disclosure, Consultation and Participation;
- A Grievance Redress Mechanism;
- Application of pollution prevention and control technologies and practices consistent with international good practice;
- Occupational and Community H&S.

Still according to ADB's SPS (2009), an EIA report includes the following major elements: (i) executive summary, (ii) description of the project, (iii) description of the environment (with comprehensive baseline data), (iv) anticipated environmental impacts and mitigation measures, (v) analysis of alternatives, (vi) environmental management plan(s), (vii) consultation and information disclosure, and (viii) conclusion and recommendations.

3.3.4 Other Relevant Guidelines

Other international guidelines relevant for the Project are:

- EU EIA-Directive (2011/92/EU amended by Directive 2014/52/EU)
- EU Directive 2013/35/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)
- EU Directive 2008/98/EC on waste (Waste Framework Directive)
- ICNIRP (International Commission on Non-Ionizing Radiation Protection): Guidelines for Limiting Exposure to time-varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)

3.4 Environmental Standards

This Section presents a summary of the environmental standards applicable to the project, including national, international and performance guarantee standards/limits.

Table 3-2: Limit values for noise regarding population (IFC/WB General EHS Guidelines)

Receptor	**One Hour $L_{Aeq\ (dB\ A)}$**	
	Daytime 7:00 – 22:00	**Night-time 22:00 – 7:00**
Residential; institutional; educational	55	45
Industrial; commercial	70	70
Noise impacts should not exceed the levels given above, or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site.		

Table 3-3: Limit values for noise regarding population (Sanitary Norm N2-III-11.3)

Receptor	**One Hour $L_{Aeq\ (dB\ A)}$**	
	Daytime 7:00 – 22:00	**Night-time 22:00 – 7:00**
Residential	55	45
Industrial	50-80	
Plant fence		
The limits refer to the total environment noise (the power plant contribution including the Current sound pressure (“ante operam” sound pressure))		

Table 3-4: Limit values for noise regarding workers

IFC/WB General EHS Guidelines: No employee should be exposed to a noise level greater than 85 dB (A) for a duration of more than 8 hours per day without hearing protection'.
Armenian legislation: Construction workers will wear ear protection devices as part of their Personal Protective Equipment (PPE), if they are exposed to noise levels higher than 80 dB (A).

Table 3-5: Performance Guarantees of YCCPP-2 - noise (ArmPower 2017)

The average A-weighted sound pressure level of the turbine halls 1.5 m above ground level and at 1 m from the turbine installation shall not exceed 80 dB(A).
The A-weighted sound pressure level of the overall plant at the plant boundary 1.5 m above ground will not exceed 50 dB(A) the noise occurring in the free field (before construction is started).
A 3 dB(A) plant noise level (measured as incremental noise from the base line measured before plant is completed at plant fence)

Table 3-6: IFC air emission guidelines for facilities larger than 50 MW with combustion turbines (IFC, 2008)

Pollutant	**EG for combustion turbines; facilities > 50 MWth**
	Natural Gas
NO2	51 mg/Nm3
Dry gas, excess O2 content	15%
Temperature flue gas	0°C

Table 3-7: Performance Guarantees for YCCPP-2 - air emissions (ArmPower 2017)

Pollutant	**Performance Guarantees**
CO	30 mg/Nm3
NO2	50 mg/Nm3
UHC	10 mg/Nm3
Dry gas, excess O2 content	15%
Temperature flue gas	0°C
Load	From 70% to 100%

UHC: Unburned Hydrocarbons

Table 3-8: National and ECD Ambient Air Quality Standards

Pollutant		Averaging period	Air Quality Standards [µg/m³]	
			National MAC	ECD
CO		Short-time	5,000	-
		24 hours	3,000	-
		Max. daily 8 hour mean	-	10,000
NO2		Short-time	200	-
		1 hour	-	200 Not to be exceeded more than 18 times per year
		24 hours	40	-
		1 year	-	40
UHC	Methane	-	-	-
	Ethane	-	-	-
	Propane	-	-	-
	Butane	Short-time	200,000	-
	Pentane	Short-time	100,000	-
		24 hours	25,000	-
PM10		Maximum	300	-
		24 hours	60	50 Not to be exceeded more than 35 times per year
		1 year	-	40
SO2		Maximum	500	-
		1 hour	-	350 Not to be exceeded more than 24 times per year
		24 hours	50	125 Not to be exceeded more than 3 times per year

ECD: European Council Directives
UHC: Unburned Hydrocarbons
MAC: Maximum Allowable Concentration

Table 3-9: Effluent Conditions as given in ArmPower Design Data, Effluent Standards for YCCPP-1 set by MNP, and applicable Effluent Guidelines for wastewater from thermal power plants (Source: IFC/WB EHS Guidelines for Thermal Power Plants)

Parameter	mg/l (except pH, temp. and total coliform bacteria)		
	Effluent conditions as given in ArmPower Design Data	**Effluent Standards for operation of YCCPP-1**	**IFC/WB Effluent Guidelines (to be applicable at relevant wastewater streams)**
pH	6.5 – 8.5	6.5 – 8.5	6 – 9
Total suspended solids	50	40	50
Biochemical oxygen demand (BOD)	6	6	
Chemical oxygen demand (COD)	30	30	
Dissolved O_2	> 4	> 4	
Smells, odors	1 level	should not exist	
Coloring	shall not exist in 10 cm column	shall not exist in 10 cm column	
Oil	10	0.3	10
Cu	0.1	0.1	0.5
Fe	0.5	0.3	1.0
Chlorides		350	
Sulfates		500	
Total coliform bacteria		< 1000 MPN/l	< 4000 MPN/l*
Temperature increase by thermal discharge from cooling system		Temperature of waste water: 5° C – 23° C	< 3°C increase of ambient water temperature*

* according to IFC/World Bank Group General EHS Guidelines
MPN = Most Probable Number

Table 3-10: Limits defined by ICNIRP to manage human exposure to electric and magnetic fields

Source	El. Field strength [V/m]	Magn. flux density [µT]
ICNIRP recommended 50/60 Hz Reference levels for exposure to time-varying electric and magnetic fields (unperturbed r.m.s. values)		
occupational exposure	10,000	500
general public exposure	5,000	100
Limit values according to the European Directive 2013/35/EC exposure of workers	10,000	500

r.m.s. = root mean square (value)
ICNIRP=International Commission on Non-Ionizing Radiation Protection
These limits also conform to the values given in European Directive 2013/35/EC for the exposure of workers.
In some countries of the former USSR a formula is used to calculate the allowed exposure time of workers, that is:
$T_{[hrs]} = 50/E - 2$

E = electric field [kV/m]

That means that the exposure time in an electric field of 25 kV/m is 0 hrs. Working in an electric field of 25 kV/m or more is not allowed without special protecting clothing.

3.5 Gap Analysis between National and International Legislation

The legal framework of the Republic of Armenia does in the essence correspond with the international regulations and safeguards. Gaps however do exist in enforcement of the regulations. There is still a considerable lack of institutional capacities for implementation, monitoring and evaluation.

There have been improvements during recent years, compared to the analysis of CENN (2004) on Effectiveness of Environmental Impact Assessment (EIA) System in Armenia, but some problematic issues still persist. There is a lack of specific Social and Environmental (S&E) qualification of governmental staff and a specific S&E department does often not exist in the implementing institutions, partly the existing structures are overloaded with work and staff is not sufficiently remunerated. In some cases, power relations are unfavorable to guarantee an effective enforcement. To some extent, the number of highly qualified staff is not sufficient to cope with the amount of work to guarantee an effective enforcement of the regulations.

The lack of access to legal support and lack of trust in the institutions, especially for weaker sections of the society may create further gaps concerning implementation of compensation and resettlement. Additional training would be a necessity but however not sufficient component to improve implementation and monitoring performance. Compliance with international safeguards could be increased with independent monitoring by internationally experienced auditors/ consultants.

Comparing the current legislation of the Republic of Armenia (RA) with IFC Performance Standards (2012), the concerning conventions stipulated by the International Labor Organization (ILO) and the related IFC/ WB EHS guidelines (2007) results in the following conclusions:

- The Constitution has the supreme legal force in Armenia. Article 6 sets the keystones of the Armenian Legislation, stipulating that laws shall conform to the Constitution, whereas other legal acts (mainly Decrees of the President and Decisions of the Government) have to conform both to the Constitution and the laws.
- International agreements come into force after being ratified or approved, being then converted into a constituent part of the legal system of the Republic of Armenia. They supersede Armenian Legislature. International agreements not complying with the Constitution cannot be ratified.
- The Law of the Republic of Armenia on Environmental Assessment and Expertise (2014) defines the framework for the Project, covering environmental and social aspects of the proposed activities.
- In Armenia, the Labor Code is the general legal act that regulates labor relationship. The specific features for regulating particular spheres of labor relations may be determined by other laws.
- The IFC Performance Standard 2 on Labor and Working Conditions is based on a number of international conventions and instruments, including those of the International Labor Organization (ILO) and the

United Nations (UN). All of them are ratified by the Republic of Armenia, except "UN - International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families", which has only been signed and ratification is still pending.

- The remaining IFC Performance Standards are covered by a range of Laws, Government Decisions, Decrees and Orders.

4. Description of the Project

4.1 Summary Technical Description

A combined-cycle plant produces electricity and captures waste heat from the gas turbine to increase efficiency and electrical output (see Figure 4-1). The compressed air is mixed with fuel that is heated to a very high temperature. The hot air-fuel mixture then moves through the gas turbine blades, making them spin. A generator is driven by the fast-spinning turbine and converts the spinning-energy partly into electricity. A Heat Recovery Steam Generator (HRSG) captures exhaust heat from the gas turbine that would otherwise escape through the exhaust stack. The heat is used to produce high pressure steam which is delivered to the steam turbine to produce additional electricity. In a multi-shaft CCPP, in contrary to a single-shaft CCPP, each gas turbine and each steam turbine has its own generator.

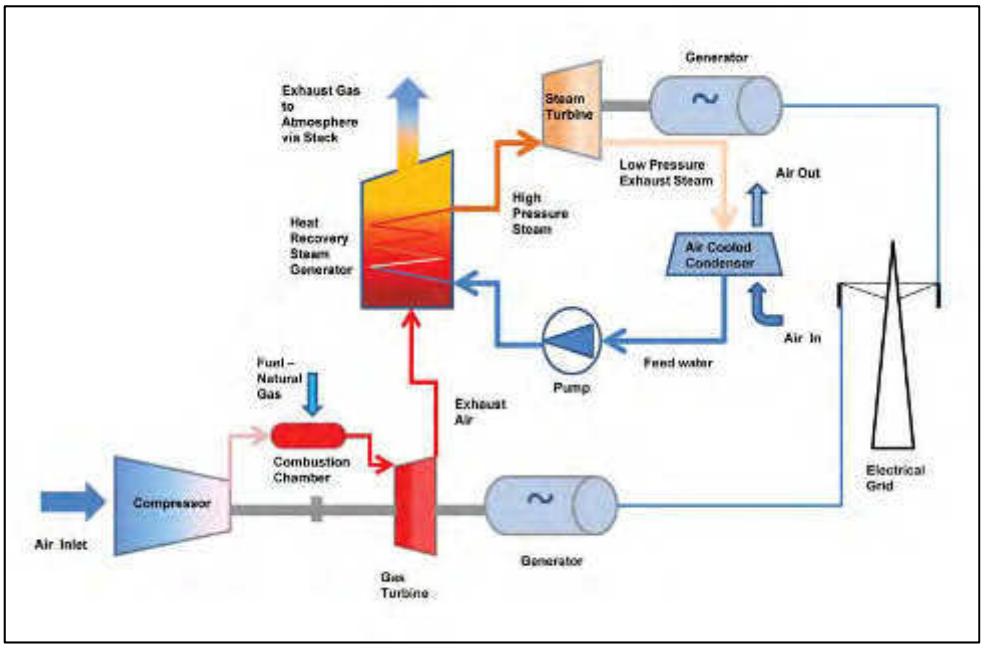

Figure 4-1: **General design of a Combined Cycle Power Plant** [5]

Sophisticated design will minimize operational and maintenance working load and so increase the reliability and availability of the total plant. For optimizing the layout of the new power plant, coordinated building and plant area location and orientation are considered to minimize influences due to meteorological conditions and to realize better accessibility during construction, installation and maintenance. Special attention is paid to the power plant internal roads, interconnecting route and access requirements for construction, erection, operation and maintenance to minimize interference and crossing of main routes and to obtain short connection paths of main piping and cabling ways.

[5] http://www.wrexham-power.com/wrexham-energy-centre-eng.html

The new power plant, owing to its multi-shaft design, will have the immense advantages of higher efficiency, wider flexibility, higher availability to the maximum extent with simple piping arrangement.

The following technical description and the components specifications are taken from the Basic Engineering Design Data (ArmPower, 2017):

Already existing main access roads and auxiliary systems of YCCPP-1 such as water intake and discharge structures, fuel gas regulators, substation for power evacuation, etc. shall be used also for YCCPP-2:

- The water supply for YCCPP-2 shall be branched from the existing water pipelines which serve YCCPP-1 and are located near to the new power plant. Two water supply systems are foreseen for drinking water and raw water.
- The fuel gas source will be branched from the existing pipeline located in the proximity of the new power plant.

The new power plant will consist of a gas turbine with generator (GTG), a Heat Recovery Steam Generator (HRSG), and a steam turbine with generator (STG) which will be installed in a new West East shaft centerline (see Figure 4-2), and related auxiliaries.

The Gross Power output at Design Conditions and 'Base Load' operation mode of the combined cycle (GT Gross Power output + ST Gross Power output) is:

- Guaranteed Gross Power Output: 254 MW (at design conditions)
- Gross Heat Rate (based on LHV: 47,479 kJ/kg): 6,438 kJ/kWh
- Efficiency: 55.91%

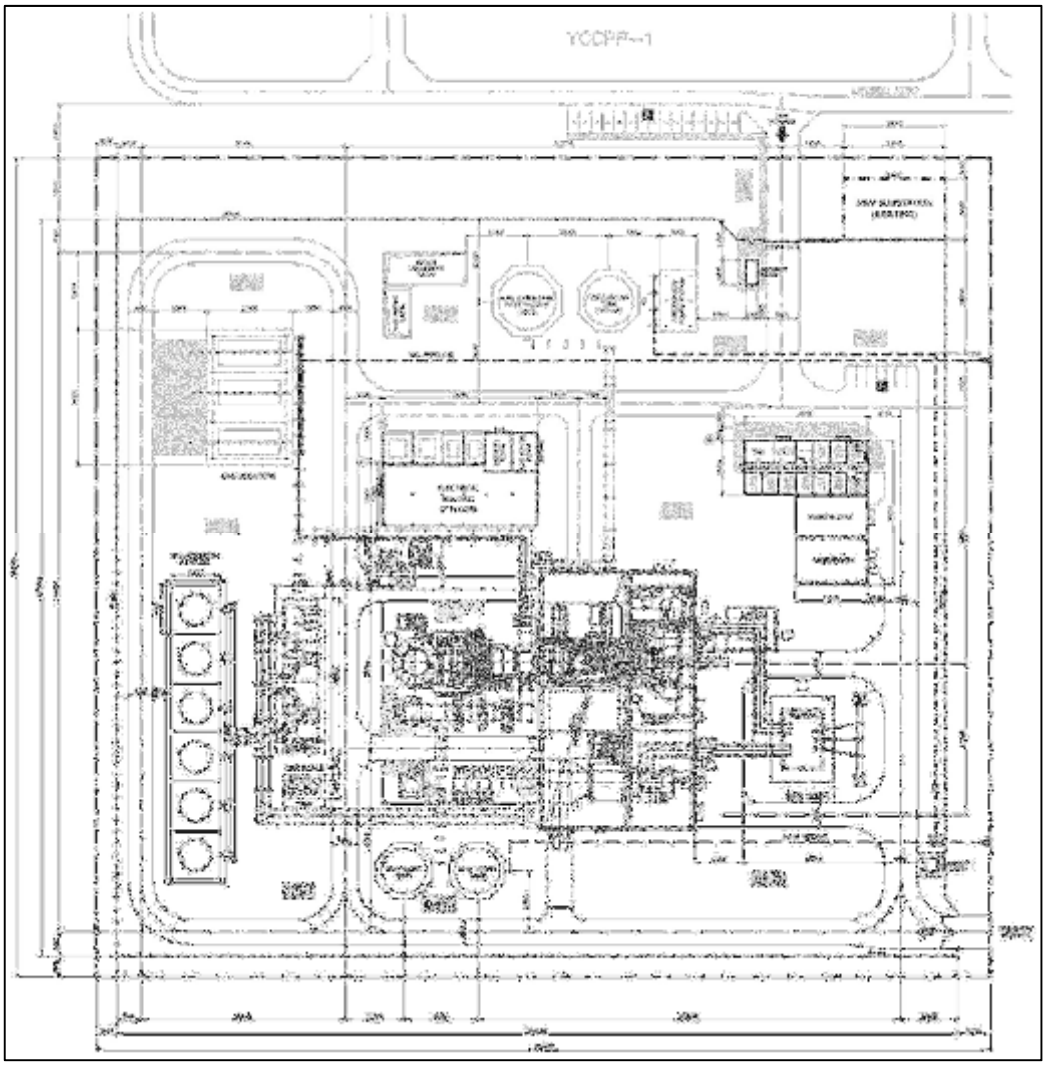

Figure 4-2: YCCPP-2 Key Plan (Source: RENCO SPA Feasibility study)

The new power plant will be designed for full power generation mode, but will also be capable to run at partial load operation. The design life for YCCPP-2 is set to 20 years. YCCPP-2 will include the following main elements:

Gas Turbine

The gas turbine package will mainly be composed by:

- Air compressor (axial type driven directly by the gas turbine, coupled at the same shaft)
- Burner (dry low NO_X)
- Gas Turbine (installed into a dedicated enclosure)
- Gas Turbine Air Preheater System
- Anti-icing System
- Evaporative Cooler
- High Fogging System
- Fuel Gas Filtration Skid
- Main Lube Oil System

The highly efficient gas turbine with the dry low NOx combustion system is coupled with a generator. The gas turbine will convert the fuel energy into mechanical energy to drive the generator. The gas turbine will be designed to be continuously operated at loads from 75% up to full load rating. It will be out of service only for periodical maintenance. The combustor will be designed of low NOx type to keep NOx emission level low. A part of compressor flow will be extracted for cooling turbine blades. The gas turbine will be provided with an air inlet system both filtering and silencing of the combustion air. Dust laden outside air will flow into a field of two stage high efficiency filter system.

Heat Recovery Steam Generator

The exhaust gas flows inside the HRSG in counter current with the high pressure boiling feed water. It shall be an outdoor, two pressure level type with a main stack, condensate preheater, low pressure drum, low pressure evaporator, low pressure super heater, high pressure economizer, high pressure drum, high pressure evaporator and high pressure super heater. A Blow Down vessel will collect all continuous and non-continuous drains from HP and LP drums. A stack provided with a Continuous Emissions Monitoring System (CEMS) will be installed at the end of the HRSG. The height of the stack is foreseen to be of 35 meters.

Steam Turbine

The steam, produced and superheated in the HRSG, is supplied at two different pressure levels to the Steam Turbine stages (High pressure stage and Low pressure stage). The turbine is provided also with a high pressure and low pressure bypass. The exhaust steam discharged by the turbine is condensed by a cooling water exchanger. The condensed mixture of steam and air will be discharged to a suitable drain.

Main Generators

Two generators will be provided to the new plant:

- Generator for the gas turbine: nominal capacity 205 MVA at 15.0 kV
- Generator for the steam turbine: nominal capacity 100 MVA at 11.5 kV

The two generators will be capable of operating at power factor of 0.9 lagging to 0.9 leading. They shall be connected by MV bus duct through No. 1 three winding step up transformer (15-11,5/220 kV) for the connection to the new 220 kV substation. The connection between the transformer and the substation shall be provided by high voltage power underground cables or by overhead transmission line.

Emergency Diesel Generator System

Emergency Diesel Generator System shall be 400V, 50 Hz connected to LV Power Center in the electrical building. The emergency Diesel Generator will be deigned to feed all emergency load in case of power failure.

Instrument/ Service Air Stream

The instrument air compressor package shall be provided with 2x100% + 10% extra capacity screw compressors oil free type. Two air dryers heatless type designed for 100% (+10 % overdesign) of the maximum compressor capacity shall be foreseen. Between compressors and dryers one buffer vessel of appropriately designed volume shall be foreseen in order to dump the pulsation. Downstream the dryer a storage vessel of sufficient capacity to assure 15 minutes shall be provide the instrument air consumption for plant shutdown scenario.

Auxiliary Boiler

A fired auxiliary boiler shall be provided, in order to guarantee the start-up activities of power train and the building heating during the Plant Shutdown. The boiler will be fed by fuel gas. The required design duty shall be evaluated.

Main Cooling System

The main cooling system will consist of a system of six evaporative towers designed for 110% of maximum flow rate and duty. Evaporative towers shall be designed also to have a low drift phenomena to limit the water make up. Number three 50% capacity (+ 10% overdesign) vertical pumps shall be provided to pump water to Steam Turbine condenser; three (each at 50% capacity) other pumps shall be installed to provide the water circulation in closed cooling water circuit.

Fuel Gas Supply System

The Plant shall be operated on the specified fuel gas without any backup of fuel oil. The Centrifugal compressors shall be designed for the available fuel gas composition and quality. The compressor, without the use of a bypass, shall be suitable for continuous operation at any capacity at least 10% greater than the predicted surge capacity.

Demineralized Water System

The Demineralized water production package is part of TP supply and will provide the necessary make up for Combined Cycle consumption.
Unless otherwise specified the demi water system will use the reverse osmosis (RO) technology and ion exchange resin and will include:

- Multimedia Filters;
- Coagulant and Antiscalant dosing package;
- Cartridge Filters;
- Reverse Osmosis Unit;
- Deionization unit;
- Demineralized Water Storage Tank and pumps

The demineralized water is distributed to the users by three 50% Demineralized Feeding Water Pumps which supply the water to the expected pressure. The capacity of the whole system shall foresee a 10% margin; the raw water pumps and the demi water pump shall follow the sparing philosophy.

Waste Water System

The wastewater treatment system is designed to treat the oily wastewater and chemical wastewater generated at the plant to meet the following effluent conditions, which fulfill the standards of IFC/ World Bank Group EHS Guidelines for Thermal Power Plants (to be confirmed during detailed engineering):

- Total suspended solids: 50 mg/l
- Biochemical oxygen demand (BOD): 6 mgO_2/l
- Iron: 0.5 mg/l
- Copper: 0.1 mg/l
- Smells, odors: 1 level
- Coloring: shall not be in 10 cm column
- pH: 6.5 - 8.5
- Dissolved O_2 not less than 4 mg/l
- COD: 30 mg/l
- Oil production: 10 mg/l

Interconnections to gas, water and electrical grid are already in place (the new CCPP will use interconnection of existing YCCPP-1). The new CCPP shall be connected with the facilities of the existing infrastructure provided below:

- Electricity: The new 220 kV substation is just under construction; the connection from the new power plant to the new substation will be via a new overhead transmission line or via a new underground cable; the distance between the new power plant and the new 220 kV substation is approx. 400 m
- New connection to the natural gas supply pipeline system, approx. 550 - 600 m
- New connection to the city water system (make-up water), approx. 1,000 m
- New connection to the water sewerage and discharge system, approx. 450 m / 100 m

4.2 Project Area

The YCCPP-2 site is located at 929 masl (average) at the south eastern border of Shengavit, a highly industrialized district in the southern part of Yerevan (see Figures 4-3 and 4-4). The coordinates of the site center are approximately:

- Northing: 40° 6'48.06"N;
- Easting: 44°29'49.55"E;
- Zone: 38T (WGS 84).

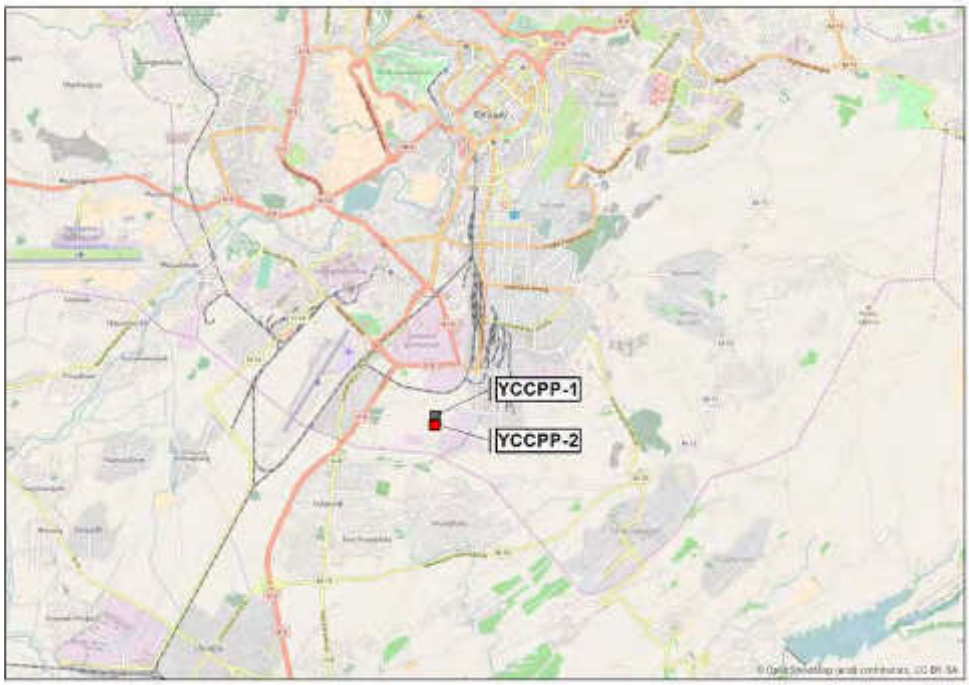

Figure 4-3: Location of existing YCCPP-1and YCCPP-2 in the south of Yerevan

The Project site is situated approx. 2 km southeast of Erebuni Airport, bordering Erebuni district and has many large industrial plants and factories in its vicinity. Despite their industrial character, Shengavit and Erebuni Districts are home to a high number of residents of Yerevan.

The following residential complexes are in the proximity of the site for YCCPP-2:

- the nearest residential area of Shengavit District (Noragavit village) is located approx. 1,350 m to the west
- Ayntap, a major village in the Ararat Province is located approx. 1,500 m to the south west
- Kharberd, another major village in the Ararat Province is located approx. 1,200 m to the south
- the nearest residential area of Erebuni District is located approx. 1,200 m to the north east.

The Project Area thus comprises the YCCPP-2 site and the adjacent residential areas, as those might be impacted e.g. by air emissions during operation of the new power plant.

Figure 4-4: Project Area located south of Yerevan, including nearest residential areas

4.3 Schedule for Project Realization

For the construction of the YCCPP-2, approx. 30 months are estimated. Thus, it is expected that the new power plant will be commissioned at the end of 2019/ beginning of 2020.

5. Analysis of Alternatives

5.1 The 'No Project' Scenario

The 'No Project' Scenario describes the situation without implementation of the Project. In this alternative, all environmental and social impacts of the Project would be avoided but it would potentially have negative implications on the regional power supply, as well as on potential business opportunities.

5.2 Comparison of Alternatives and Options

5.2.1 Location

The foreseen site location allows co-utilizing the existing auxiliary systems of YCCPP-1 such as water intake and discharge structures, fuel gas regulators, substations and devices. Possible alternative locations for the proposed new YCCPP-2 were considered prior to opting for the foreseen site. On account to minimize environmental impacts and additional costs for newly developing such a site and modifying the transmission network to accommodate the new power plant, the foreseen site was selected, together with MOE as a final option.

5.2.2 Alternative Methods of Power Generation

There are basically three different types of energy production:

- Renewable energy: common resources used are water (hydropower), wind, solar and geothermal power;
- Nuclear energy;
- Thermal energy.

Renewable energy
Special regard is taken on the renewable energy sources, because they are considered as the basis for a sustainable future power system development. Nonetheless, they face several constraints:

In order to produce the same amount of electricity as the YCCPP-2 using hydropower, a large dam would need to be build. The environmental and social impacts of large dams may be difficult to mitigate and manage. Alternatively, a cascade of medium sized dams would need to be build, or the energy production of several independent hydropower plants would need to be combined. This would spread the environmental impacts through several locations, making them more difficult to handle and control. In addition, according to SREP (2014), the identified potential for HPP investment in Armenia is of only up to 90 MW. This is not sufficient to compete with the energy output of the YCCPP-2.

In the dry climate of Armenia, solar energy is quite favorable. The potential for development of the photovoltaic industry in Armenia has been studied in the framework of the project "Assistance for Development of Actual Solar PV Energy in Armenia". Based on this, a Renewable Energy Investment Plan for Armenia was approved, in accordance to which resources are being allocated to develop up to 110 MW utility-scale photovoltaic plants. [6] However, some constrains are imposed: high land consumption, the need for great investments and, based on SREP (2014), the limited capacity for equipment acquisition and installation, together with a lack of experience with the technology in Armenia

Given the above, solar energy is not considered at this stage to be an alternative to thermal generation in Armenia, but instead a complementary energy source which is being planned under parallel programs, and which faces different challenges to be overcome in the right instances.

Wind is an unsteady energy resource. Both its varying direction and intensity do not allow guarantying that energy is always produced, which would be a disadvantage in comparison to thermal production, especially at a time when the pressing need to replace the nuclear power generation emerged in Armenia. Besides, the Ministry of Energy and Natural Resources plans to develop up to 500 MW of its wind energy potential by the year 2025. 500 MW is the amount that can be economically feasible for commercial utility scale presently (US AID, 2010). This implies that further investments in this technology are presently not feasible.

In the field of geothermal energy, big advances were made to spread these technologies. They are generally considered as reliable, cost effective and sustainable. Nonetheless, there are still serious and long-term researches required for the arrangement of geothermal energy production, making it a disadvantageous source for the case at hand, where a pressing energy demand requires a solution which is readily and easily implementable.

Nuclear energy

Nuclear power is electric power generated in a nuclear reactor. Nuclear power stations generally work in a similar way as conventional fossil fuel-burning stations. The main difference is the fuel. Nuclear fuel is typically uranium-based rods, instead of coal or gas. Nuclear Power plants do not create smoke or carbon dioxide and are more reliable compared to above mentioned renewables. Although power generation does not produce much waste, the residual radiation of the waste is so dangerous that it requires sophisticated handling for years and centuries to come. Nuclear reactors are discussed controversial, with many people categorizing them as inherently unsafe.

Despite laying in a seismically active zone, Armenia has one operating nuclear reactor (Metsamor) and there are plans to build another. There are

[6] http://www.minenergy.am/en/page/416

many controversies and concerns about its security. Given the environmental risks derived from an eventual failure of the power plant, as well as the difficulties in the management of the waste, this is considered a disadvantageous alternative.

Thermal energy
Thermal energy uses organic fossils for energy production, therefore releasing formerly stored greenhouse gases which contribute to climate change. This makes it generally unfavorable from an environmental point of view. It has to be considered that power stations working on the basis of natural gas have far less impact on the environment than stations working on the basis of other fuel types. Besides, they are less capital-intensive. Modern gas turbines allow to significantly increase the efficiency and to reduce the generation of combustion outcome.

Given these considerations the option of gas and steam combined cycle power plant was chosen.

6. Description of the Environment (Baseline Data)

The following chapter provides baseline data for the Project Area focusing on the subjects of protection: fauna and flora, soil, water, climate, air quality, noise, landscape, historical and cultural sites and socio-economic conditions.

The following documents have already been prepared to the Project and have been used, among others, as a basis for writing this Section:

- RENCO SPA: Armenia 250 MW CCGT Yerevan Capital City. Draft Feasibility Study [CCGT 250 MW – Yerevan /Armenia]
- Ecobarik-Audit LLC (2016): Report of Evaluation of Environmental Impact of the new Steam and Gas Combined Cycle Power Plant in Yerevan
- Geoterproject LTD (2016): Report on engineering-geological survey of Yerevan TPP new energy block area
- ArmPower CJSC (2017): Geological Report of Armhydroenergyproject CJSC
- Consecoard LLC (2017): Report on Monitoring Services

6.1 Environmental Conditions

6.1.1 Flora, Fauna and Biodiversity

The Republic of Armenia is a mountainous country characterized by a rich diversity of plants and animals, as well as landscapes and vegetation types. More than 3,800 species of vascular plants and more than 17,700 animal species including 549 species of vertebrates are found on the territory of Armenia. The biodiversity of Armenia is notable for its high endemism: about 500 species of fauna and 144 species of flora are considered endemics (MNP 2014).

The foreseen construction area of YCCPP-2 is bordering the already existing YCCPP-1. The construction site is part of the Yerevan industrial area. The construction site itself and the surrounding land are poorly vegetated with much of the area having been disturbed by industrial developments in the past. Detailed data about flora and fauna at the construction site do not exist, however, only sparse vegetation composed of grass, herbs and some bushes can be found at the construction site. The biodiversity value of the Project Area is assessed to be low.

Figure 6-1: Typical vegetation at the construction site (YCCPP-1 in background)

6.1.2 Protected Areas

Biodiversity conservation in Armenia is implemented mainly in the specially protected natural areas, where 60-70% of the species composition of the flora and fauna is concentrated including the overwhelming majority of rare, critically endangered, threatened and endemic species.
According to MNP (2014) at present approx. 13% of the total territory of Armenia are covered by protected areas. These comprise 3 state reserves, (Khosrov, Shikahogh and Erebuni), 4 national parks (Sevan, Dilijan, Arpi Lake and Arevik), 232 natural monuments, and 27 state sanctuaries.

However, no Protected Areas are located within or in the vicinity of the Project Area. Also no other sensitive areas like Important Bird and Biodiversity Areas (IBA) or Ramsar Sites are located near the Project Area.

6.1.3 Geology and Seismic Situation

6.1.3.1 General Geological Conditions of the Area

Yerevan is part of the quaternary geologic unit. According to MNP (2002), Armenia is a part of the Transcaucasus great arched fold and medium-Araxian intermountain lowering. These two geological structural units are included in the Caucasus-Anatolia-Iranian segment of the Mediterranean plicate zone. Given the time of establishment of geological structural units and accomplishment age of plicate formation the territory of Armenia is divided into the Somkheti-Ghapan complex, Bazum-Zangezur and trans-Araksian zones.

The trans-Araksian weak plicate zone is divided into the Yerevan-Ordubad and orogenic lowering sub-zones. The Project area is part of the Yerevan-Ordubad sub-zone which is located in the south of the Bazum-Zangezur

zone and is characterized by meogeocyncline type. Land, carbonate, ophyolite, volcanic and sedimentary formation stratums, as well as volcanic origin and land formations of Quaternary period are found here. The sub-zone is composed of two structural units: the Yerevan-Ordubad concave fold and Urts-Vayots Dzor arched fold.

6.1.3.2 Tectonics and Seismicity

Armenia is located in a seismically active zone stretching from Turkey to the Arabian Sea. Here, the Arabian landmass slowly collides with the Eurasian plate. As large earthquakes with magnitudes over 5.5 occur in Armenia every 30 to 40 years reaching magnitudes up to 7.1 on the Richter scale, a high-level seismic hazard is indicated for the country. The Garni earthquake in 1679 was the most destructive one, with a magnitude oscillating between 5.5 and 7. Another destructive earthquake with a magnitude of 6.9 occurred in Spitak in 1988[7]. In 2011 an earthquake with a magnitude of 3.2 occurred 37 km north of Gyumri[8].

Maximum seismic risk is given around the city of Yerevan, where the Project Area is located, and in a zone from Gyumri to Vanadzor and the northern part of Lake Sevan, where active faults exist.
Seismic stability of 9 magnitudes by Richter scale and more is to be followed because the country is classified as the third seismic zone under MSK 64 standards with an acceleration value of 0.4G m/s and a speed of 32 cm/s.[9]

6.1.3.3 Field Investigations at the Construction Site

In order to ensure the proper setting of YCCPP-2, a geotechnical investigation program has been performed[10]. The program comprised execution of core drillings, engineering-geological reconnaissance surveys and collection and review of existing geological data. The scope of investigations was set to determine the natural, geo-mechanical and geo-hydraulical characteristics of the underground, as well as groundwater levels and the location of rock surfaces, if any.

Another geological study[11] has been performed in 2017 by "Armhydroenergyproject" CJSC in the construction site area including topographic mapping, geophysical and engineering geological works, experimental borehole drilling, piezometer installation in some boreholes to

[7] http://info.worldbank.org/etools/docs/library/114715/istanbul03/docs/istanbul03/09melkumyan3-n%5B1%5D.pdf
[8] http://www.emsc-csem.org/Earthquake/earthquake.php?id=210376
[9] RENCO SPA: Armenia 250 MW CCGT Yerevan Capital City. Draft Feasibility Study [CCGT 250 MW – Yerevan /Armenia]
[10] Geoterproject LTD (2016): Report on engineering-geological survey of Yerevan TPP new energy block area
[11] Armpower CJSC (2017): Geological Report of Armhydroenergyproject CJSC

measure the ground water level fluctuation, periodic measurement of water level and sample taking.

The following main outcomes are taken from the geological studies:

- The territory‘s geological-lithological structure is mainly formed by clayey soils, in some places covered by fill up soils.
- In the study site the 2nd and the 3rd layers can serve as foundation bottom.
- In the study area underground waters have been detected in all the boreholes with 0.5-7.0 m depth and have seasonal fluctuation from 0.5 to 1.0 m. According to the laboratory data, the detected underground waters have strong sulphate aggressiveness against ordinary concrete.
- There are no hazardous physical-geological phenomena and processes (landslides, rock slides, rockfall, erosion, suffosion, etc.) in the study area.
- According to RA Construction Standards II-6.02-06 the guideline largely passes by the third (III) seismic zone (9 points and more). The class of the soils of the areas according to their seismic characteristics belongs to the II (second) and III (third) classes.
- The maximum depth of frost in soil is 60 cm.
- The study area is suitable for capital construction.

6.1.4 Soil

In the area where the Project will be situated, semi-desert alkali soils are common. The warm, mild and variable humid climate, the long period of active soil formation, presence of sufficient drainage system and seasonal change in ground streams direction promote deep and intensive weathering of primary minerals, formation of secondary mineral substances and rather thick clay soils. The geological structure of the area and the study site is represented by radical clays, generally covered by contemporary alluvial, diluvial-proluvial, and technogenic generations, formed of clayey and sandy soils.

The geological studies which were performed at the construction site found mainly clayey soils which are in some places covered by fill up soils.

There are no direct hints to a historical soil contamination of the construction site. According to the information gathered during the site visit in July 2017, the site has never been covered by buildings. The area might have been used for illegal disposal of different waste materials in the past, however during the site visit in July 2017 no asbestos-containing material or other hazardous waste was found, except for some empty oil drums at two different spots. Near to these drums the topsoil was found to be contaminated by an oil leakage (see Figure 6-2). During the site visit in July 2017, FICHTNER’s environmental specialist took samples of the contaminated soil at each of the two spots. The samples were analyzed by a certified laboratory in Germany for contents of PCBs. All PCB

concentrations were below the detection limit of 0.2 ppm (see Section 13.2 in the Annexes for test results).

In August 2017 a monitoring study was performed regarding groundwater quality and possible historic soil contamination at the construction site. Sampling was conducted according to the methodology of the "Environmental Monitoring and Information Center" SNCO of the Ministry of Nature Protection and the samples have been analyzed for metal content at the laboratory of the named institution. The study concludes that soil quality is in line with the general characteristics of the region and is within the limits of permitted norms (Consecoard LLC 2017). For details and analysis results see Section 13.3 in the Annexes.

Figure 6-2: Oil leakage near to some empty oil drums at YCCPP-2 site

6.1.5 Water Resources

6.1.5.1 Surface Water

The Republic of Armenia is covered with a dense net of rivers. Armenian rivers belong to the Caspian Sea basin. Basins of the tributaries of Kur River occupy an area of 700 km^2 (Debed, Pambak, Aghstev, Tavush Rivers, etc.), and basins of the tributaries of Arax River an area of 22,790 km^2 (Akhuryan, Kasakh, Metsamor, Hrazdan, Azat, Vedi, Arpa, Vorotan Rivers, etc.). Armenia's rivers have mixed feeding - melting, groundwater, and rain. Their flow changes considerably within a year. During summer-time and fall, when water demand is approaching its maximum, the annual water share amounts to 20-25 %, in winter-time to 10-12 % of the total flow, whereas in spring-time is 55-70 %.

The Republic of Armenia is not rich in lakes. Sevan is the biggest lake in the Caucasus and Armenia. Its surface amounts to 1,240 km^2. The lake is located at an altitude of 1,897 m a.s.l. The rest of the lakes in the country (Kari, Akna, and Sev, etc.) are small and mostly located in the highland

zones. Lake Arpi and Lake Parz (in Dilijan National Park) are located at a medium altitude highland zone. Lake Ayghr is a lowland lake fed by underground waters.
The Hrazdan River is the primary waterway in Armenia and the country's second largest river. While the Hrazdan River receives effluent from various agricultural, commercial, industrial, and residential sources, it is most significantly impacted by the discharge of Yerevan's almost entirely untreated wastewater. The effects of this poorly treated wastewater are evident through a variety of water quality indicators, most notably through drastic drops in dissolved oxygen levels downstream of the city[12]. Water quality of the Hrazdan River is categorized as bad (5th class of the surface water quality assessment system of RA) in the area south of Yerevan[13].

Regarding the Project Area, the nearest water body, Artashati Jrants Canal, is located 700 m south east of the construction site. No water from the canal will be used for YCCPP-2 and no water will be discharged to it. It is planned that YCCPP-2 will co-utilize the existing auxiliary systems of YCCPP-1 including water intake from grid and discharge structures.

6.1.5.2 Groundwater

According to one of the geological studies[14] the main water horizon at the construction site is connected with quaternary age sediments, which are spread on Miocene age hydrophobic clays. In quaternary water sediments the ground waters have widespread diffusion. These waters are non-pressure ground water flow, which is directed towards the incidence of the relief. The mentioned water horizon is fed by technical waters through precipitation, which penetrate into old CCPP area from Artashat channel underground drain and irrigation waters. The latter plays a great role connected with the intensity of irrigation associated with water level in the area. In the area of Yerevan CCPP during different years, ground water level fluctuate measuring data have shown that there is no pattern which proves that ground water level is related to irrigation, discharge of technical waters and drainage works.

Besides the described main horizon of the ground waters, also layer waters with weak pressure are met, the level height of which from pit mouth is 0.3 m, which extends in Miocene age clays, in first layers and sub layers of sand. These layers have weak water tankage; in some places they supply to the water horizon and in some way affect its chemical composition. According to the archival materials the waters of the study area mainly have sulphate-sodium partly chlorine-sulphate-magnezum chemical composition. Ground waters existing in the area are considered to be strong saline, where the content of dissolved minerals according to archival materials fluctuates

[12] http://ace.aua.am/monitoring-dissolved-oxygen-in-the-hrazdan-river/
[13] Ecobarik-Audit LLC (2016): Report of Evaluation of Environmental Impact of the new Steam and Gas Combined Cycle Power Plant in Yerevan
[14] Armpower CJSC (2017): Geological Report of Armhydroenergyproject CJSC

from 1,949 mg/l to 1,0884.4 mg/l that is why they have a sulphate aggressive attitude to concrete marks.

According to one of the geological studies[15], the groundwater level in the Project area is located at a depth of 0.5 to 7.0 m and shows a seasonal fluctuation of 0.5 to 1.0 m.

An additional monitoring study was performed in August 2017[16] regarding groundwater quality and possible historic soil contamination at the construction site. Sampling was conducted according to the methodology of the "Environmental Monitoring and Information Center" SNCO of the Ministry of Nature Protection and the samples have been analyzed at the laboratory of the named institution. RA Government Decree "On defining water quality norms for each water basin management area taking into consideration the peculiarities of the Locality," (RA Government Decree N 75-N, dated on 27 January 2011), the surface water quality assessment system in Armenia distinguishes five classes or grades: "excellent" (1st grade), "good" (2nd grade), "mediocre" (3rd grade); "insufficient" (4th grade) and "bad" (5th grade). The government's decision envisages maximum permissible concentrations (MPC) for all classes. In case of exceeding them, the flow to water resources is prohibited.

YCCPP-2 is located in Hrazdan River basin (water shade) management area. The water in the lower stream of the Hrazdan River is classified as "bad". The results of all groundwater sampling tests were within the limits of the 5th grade of water quality, consequently the groundwater can be directed by drainage to the downstream area of Hrazdan River without additional cleaning. For details and analysis results see Section 13.3 in the Annexes.

6.1.6 Climate and Air Quality

6.1.6.1 Climate

Because of Armenia's position in the deep interior of the northern part of the subtropical zone, enclosed by lofty ranges, its general climate is dry and continental. Nevertheless, regional climatic variation is considerable. The capital Yerevan is located at the lowest altitudes of the country (between 900 and 1200 m a.s.l.). Here, the prevailing climate is a mountainous continental climate. The location is classified as BSk by Köppen and Geiger. It is characterized by hot and arid summers (Figure 6-3) and rather cold winters; in a year there are on average a hundred days with minimum temperatures below freezing. The average temperature in Yerevan is 11.6°C. In summer (July and August) the average temperature exceeds 30°C. The coldest month is January at -4°C.Generally, there is little rainfall

[15] Geoterproject LTD (2016): Report on engineering-geological survey of Yerevan TPP new energy block area

[16] Consecoard LLC (2017): Report on Monitoring Services

throughout the year; precipitation averages 319 mm. The driest months are June to October with an average below 25 mm of rain. The wettest months are February, April and May with an average of 40 mm of rain.

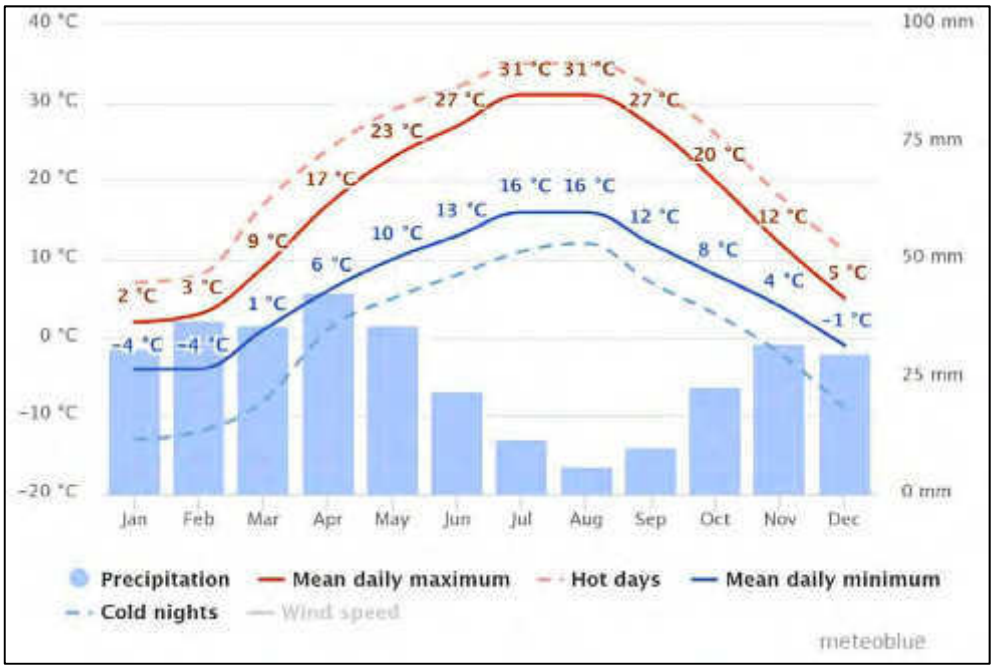

Figure 6-3: Average temperatures (min. and max.) and precipitation (mm) in Yerevan (30-year global history with hourly weather data).[17]

On average, the most wind is seen in July. The strongest wind speed is observed in March and April (> 38 km/h). On average, the least wind is seen in September. The mean monthly wind speed over the year is 6.1 km/h. The wind mainly blows from NE, SSW and S (Figure 6-4 and Figure 6-5).

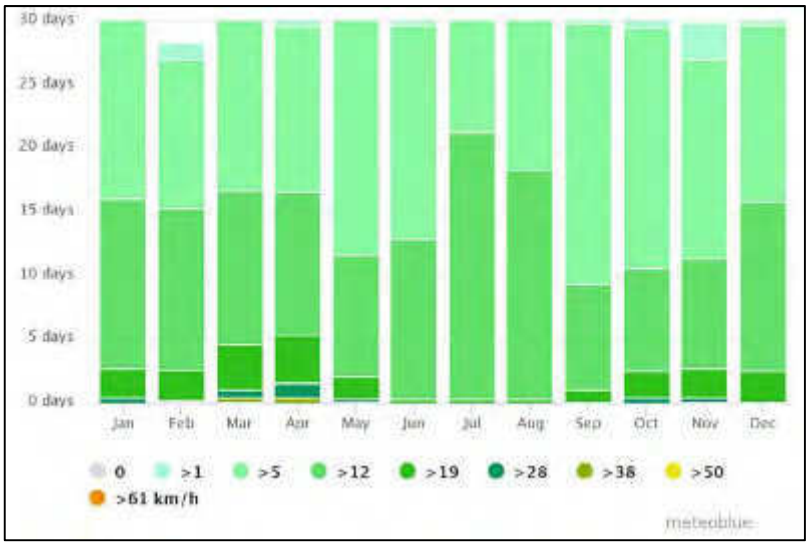

Figure 6-4: The diagram for Yerevan shows how many days within one month can be expected to reach certain wind speeds

[17] https://www.weather-and-climate.com

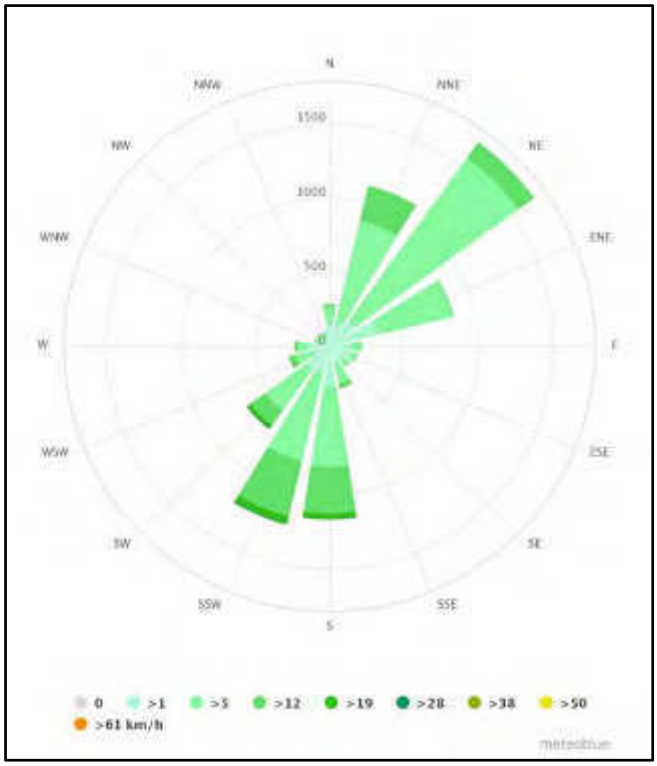

Figure 6-5: The wind rose for Yerevan shows how many hours per year the wind blows from the indicated direction

6.1.6.2 Air Quality

Air pollution has always been a sensitive issue in Armenia. According to a recent report of the WHO[18] these unfavorable conditions have hardly improved and Armenia is on the top ten list of deaths linked to air pollution in Europe, with 125 deaths per 100,000 inhabitants per annum. Although data from 2004 (when population depended mainly on solid fuel) was used, numbers are still alarming. Particulate matter (PM_{10}) is the most important air pollutant in urban atmospheres of Armenia, which is created in a considerable degree from vehicle air emissions. Old diesel vehicles, an insufficiently developed public transport and problematic traffic management lead to high emissions from motor transport.

The City of Yerevan is surrounded by mountains on three sides which does not allow for natural dispersion of pollutants in the atmosphere, thereby resulting in high concentrations in the air. The main source of air pollutants are emissions arising from automobiles.

According to Ecobarik-Audit LLC (2016) the "Environmental Monitoring and Information Center" SNCO (Ecomonitoring) of the Ministry of Nature Protection of the RA monitors the atmospheric air pollution of Yerevan city with five stationary points of measurement. On the basis of their measurements the background level of city air pollution is calculated. The

[18] WHO (2016), World Health Statistics 2016

following data on the pollution of the air basin of Yerevan are according to 2014 reference of Ecomonitoring:

- Air basin observations were done by 24-hour active sampling. The contents of dust, SO2, NOx and near-ground O3 were determined. In total 9,963 air samples were taken by active sampling. The average annual concentrations of the determined materials did not exceed the maximum permissible concentrations (MPC).
- Atmospheric air observations through automatic devices were made at five observation points in the city. The contents of CO, SO2 and NOx in the atmosphere were determined. In total 347,538 observations of air were made through automatic devices. According to the data of automatic observations the average annual concentrations of the materials determined in the atmosphere did not exceed the MPC.
- Air basin observations with passive samplers were made in 48 observation points of the city. 4,715 samples of air were taken, in which the average annual concentrations of SO2 and NOx did not exceed the maximum permissible concentrations (MPC).

To obtain up-to-date data about the ground level concentrations (GLC) of air pollutants in the Project Area, and help defining the airshed as degraded or non-degraded (according to the WB EHS Guidelines), FICHTNER started an air quality monitoring campaign in July 2017. This campaign included the measurement of SO_2, NO_2 and PM_{10}:

- For gases (SO_2 and NO_2), the Consultant performed a 7 day campaign with diffusion tubes, followed by a laboratory analysis.
- For particulates (PM_{10}), the Consultant performed a 5 day campaign.

The results show that the airshed surrounding the future YCCPP - 2 can be classified as **non-degraded** regarding the pollutants PM_{10}, SO_2 and NO_2. Please consult further details on this study on Annex 13.5 to this ESIA.

The monitoring campaign will be repeated in next autumn, winter and spring in order to cover all seasons of an annual cycle. The results from this additional monitoring campaign will be presented in the final version of the ESIA study. The results will be used as an input for a new simulation and an updated Air Dispersion Calculation report.

6.1.7 Noise

To obtain data about the existing noise levels in the Project Area, FICHTNER undertook a noise monitoring campaign in an area around the YCCPP-2 site at five monitoring points, including work-days and weekends at day-time as well as night-time. The results are shown in Note: On sensitive receptor R4 the limit of 70 dBa is applicable during the day and during the night.

Table 6-1. Please consult further details on this study on Annex 13.6 to this ESIA.

The campaign used the Sound Level Meter WS1361, a high precision instrument in line with the International Committee TYPE 2 ANSI S1.4 and the United States National Standard TYPE 2 IEC 651. According to The Sanitary Norms N2-III-11.3, the applicable noise limits in the residential areas are 45 dBA during the night time and 55 dBA during the day time. In the industrial areas the limits fluctuate from 50 dBA to 80 dBA depending on the category of works. The said limits are referred to the total environment noise (the power plant contribution including the current sound pressure ("ante operam" or baseline sound pressure).

Point of measurement	Wind speed (m/s)	Time of measurement	Leq(A) [dB(A)]
Work-day			
R1	<1.7	Day-time	49.8
	<1.8	Night-time	47.1
R2	<1.9	Day-time	72.6
	<2.3	Night-time	62.4
R3	<1.8	Day-time	48.1
	<1.7	Night-time	40.0
R4	<1.6	Day-time	53.6
	<1.9	Night-time	57.3
R5	<1.7	Day-time	36.2
	<2.0	Night-time	39.4
Weekend			
R1	<1.5	Day-time	43.4
	<2.1	Night-time	49.0
R2	<1.8	Day-time	72.8
	<2.5	Night-time	59.2
R3	<1.9	Day-time	43.9
	<2.0	Night-time	33.9
R4	<1.8	Day-time	56.4
	<2.0	Night-time	57.2
R5	<1.5	Day-time	35.6
	<1.8	Night-time	34.2

Note: On sensitive receptor R4 the limit of 70 dBa is applicable during the day and during the night.

Table 6-1: Results of the baseline noise monitoring at the Project site

Baseline day-time noise evaluation

Based on the noise measurement results conducted during work-days and weekend days, it can be concluded that the noise equivalent levels in/near the residential areas were generally within the applicable limits except the point R2 (located in front of the highway), where the noise level exceeded the 55 dBA normative value. This can be explained by the movement of heavy vehicles and high traffic density along the highway.

Baseline night-time noise evaluation

Equivalent noise levels during work-days and weekend days at measurement points R3 and R5 are within the 45 dBA limit. Noise levels at

point R1 during both work-days and weekend days were slightly exceeding the limit (2.1 dBA and 4 dBA accordingly). This is due to the existence of background night noise from the facilities located in the vicinities. As a result of night-time measurements, the equivalent noise level at point R2 (located in front of the highway) is above the 45 dBA limit. The reason is high traffic density along the highway even at night-time.

6.1.8 Landscape

In spite of its comparably small surface area, Armenia is topographically highly diverse. A broad range of landscapes is found. Yerevan is part of the "low mountain dry steppe" landscape zone.

The Project Area is located in a highly industrialized area in southern Yerevan. Here, the existing YCCPP-1, chemical plants, metal factories and other industrial infrastructure dominate the landscape.

6.1.9 Socio-economic Conditions

6.1.9.1 Population within the Project Area

The Republic of Armenia has a population of approx. 3 million people with a territory of 29,743 km². Population density is 101 persons/km². Nominal GDP is $10.56 billion (2015), per capita $ 3,595. The Human Development Index is estimated for 2010 at 0.733 which ranks the country 85th, the lowest among the Transcaucasian republics. After the break-up of the USSR the country has experienced a problem of population decline due to elevated levels of emigration. The rates of emigration have decreased drastically in the recent years and a moderate influx of Armenians returning to Armenia is expected to continue.
Ethnic Armenians make up 98.1 % of the population. Yazidis make up 1.2 %, and Russians 0.4 %. Other minorities include Assyrians, Ukrainians, Greeks, Kurds, Georgians, and Belarusians. There are also smaller communities of Vlachs, Mordvins, Ossetians, Udis, and Tats. Minorities of Poles and Caucasus Germans also exist though they are heavily russified.[19] According to the Statistical Yearbook of Armenia 2016[20] Yerevan has a population of 1,075,000 inhabitants with a density of 4,815 persons/km².

The population in the Project Area can be differentiated into urban population of the districts of Shengavit (approx. 140,000 inhabitants) and Erebuni (approx. 117,000 inhabitants) and the village population of Ayntap (approx. 11,000 inhabitants) and Kharberd (approx. 17,000 inhabitants).

[19] Source: Asatryan, Garnik; Arakelova, Victoria (2002). The Ethnic Minorities of Armenia. Routledge
[20] National Statistical Service of RA 2016; http://www.armstat.am

6.1.9.2 Sensitive Receptors

People living in the vicinity of YCCPP-2 might be affected by noise and air emissions during construction and operation of the new power plant. As YCCPP-2 will be located in an industrial area with the existing YCCPP-1, chemical plants, metal factories and other industrial infrastructure the newly created noise and air emissions will accumulate with the already existing burden.

This might be the case for people living in the above mentioned residential areas in the Project Area and to a group of people living in illegal housings northeast of YCCPP-1 (see Figure 6-6 and Pictures below). According to Head of Department at Yerevan Municipality Staff of the Head of Shengavit Administrative District the inhabitants of these illegal housings shall be given new housings in Yerevan within the period of one year and the old buildings shall be removed.

One of the buildings southwest of the construction site of YCCPP-2 is a fire station. According to local information there is also one woman living illegally in one of these houses (see Figure 6-6). Thus, the firemen as well as the named woman will also be affected by the above mentioned impacts due to noise and air emissions. In a distance of about 1 km from the new YCCPP-2 only these illegal housings can be found as sensitive receptors. No schools, kindergartens, hospitals, etc. are found in this area.

Figure 6-6: Location of illegal houses located northeast and south of new YCCPP-2 and of fire brigade

Figure 6-7: Illegal houses located northeast of YCCPP-1 and YCCPP-2

6.1.9.3 Livelihood and Housing

Despite economic reforms and some recent growth, unemployment and poverty remain widespread in Armenia. Agriculture is the country's largest labor sector, followed by services and industry. The UNDP report (Spoor 2004) analyses that rural poverty used to be lower than urban poverty, and access to land has been important in the explanation of this phenomenon. However, rural poverty in 2003 has surpassed its urban counterpart, stagnating at a level similar to 1996. While access to land is still widespread in rural Armenia, amongst farm households, the poor and extreme poor are those who own very little land, or the landless. The poorest Armenians are found in rural areas with the least favorable conditions for agricultural activities. There is a stark contrast between the city of Yerevan and the remote rural areas in terms of socio-economic opportunities.

6.1.9.4 Land Usage and Ownership

According to the Statistical Yearbook of Armenia (2016) RA has approx. 2 million ha of agricultural land, meaning about 70 % of the country's land area. Most of this, however, are pastures (about 1 million ha). Cultivable land comprises about 446,700 ha arable land, 34,400 ha perennial grass, 121,100 ha plough-land, and 392,200 ha others.

The Project Area is part of a highly industrialized region of Yerevan. Only the area west of the foreseen construction site is used for pasture and/or agricultural purposes. The whole area of the construction site has already been acquired by ArmPower CJSC and local population does not use the land in any way.

6.1.10 Historical and Cultural Sites

As the history of human settlement in Armenia goes back to the Neolithic age and the area has since then been important as settlement, trade and agricultural area, numerous historical and cultural sites exist. However, there are no maps indicating exact locations (GPS coordinates) of the sites. Also, only a minor part of the existing monuments are visible and known to

the public. Others are known only to a few local experts linked to the Department for the Protection of Monuments of RA.

No known historical or cultural sites are located within the Project Area. The Erebuni Museum of History and Architecture is located approx. 4 km from the foreseen construction site.

7. Environmental and Social Impact Assessment

In this chapter, possible environmental and social impacts from the construction and operation of YCCPP-2 are analyzed. Potential impacts of the Project in relation to environmental and social receptors are characterized and the extent of the impact (after implementation of mitigation measures) is assessed. The following evaluation scale is applied:

Extent of impact:

■■■	=	high negative
■■	=	medium negative
■	=	low negative
	=	nil
+	=	locally positive
+ +	=	regionally positive

7.1 Environmental Impacts during Construction Phase

7.1.1 Fauna, Flora and Biodiversity

Site preparation for the plant extension requires clearing of vegetation and ground excavation. Hence, the construction activities will result in a permanent loss of the sparse vegetation composed of grass, herbs and some bushes. As the biodiversity value of the construction site is assessed to be low, there are only low impacts on biodiversity expected during the construction phase.

Under normal dry weather conditions, a significant amount of dust will be released by excavating activities. Hence, vegetation and animal habitats in the vicinity of the site might be affected by wind-blown dust and its deposition. The contribution to the natural dust concentration in the air will only be of relevance at the beginning of the construction phase, during the main excavation activities. During this period, dust can be expected to settle on plant leaves, which could hinder plant's air exchange and assimilation.

The temporarily increased vehicular traffic coupled with high noise levels due to various construction activities may also have some negative impacts on animals. Especially birds and other acoustically orientated animals living in the vicinity of the site and the roads used can be disturbed by noise. The permanent disturbance during the period of construction could drive noise-sensitive species away from their habitats. It is expected that these species will return after construction has been finished and noise and dust levels decrease. No significant impacts by dust and noise on the flora and fauna in the vicinity of the site and the used roads are to be expected.

The impact magnitude will be low when mitigation measures are implemented. Adequate mitigation measures are possible and are given in the ESMP.

Impact of/ on	Extent of Impact (after Mitigation)
Fauna and Flora	■

7.1.2 Protected Areas

As no Protected Areas or other sensitive areas like Ramsar Sites or Important Bird and Biodiversity Sites (IBA) are located within or near to the Project Area, there will be no impacts from the Project on any of these areas.

Impact of/ on	Extent of Impact (after Mitigation)
Protected Areas	o

7.1.3 Soil

7.1.3.1 Soil Use and Soil Erosion

During construction of YCCPP-2, the loss of land is inevitable. Loss of vegetation and soil compaction increases the soils' vulnerability to erosion. Erosion can cause further unwanted interactions. Earthmoving activities such as vegetation clearing, grading and grubbing for site preparation, and heavy equipment hauling over unpaved ground, may loosen soils and cause fugitive dust and particulate matter to become airborne.

Armenia suffers significant soil erosion problems. But, compared to other regions in Armenia, the Project Area is not prone to soil erosion due to the following reasons:

- the terrain at construction site is nearly flat
- there are no hazardous physical-geological phenomena and processes (like landslides, rock slides, rock fall, erosion, suffosion, etc.) in the Project Area

Due to the restricted surface area of the planned construction activities and after implementation of the mitigation measures given in the ESMP, impacts on soil use and soil erosion are considered low.

Impact of/ on	Extent of Impact (after Mitigation)
Soil Use and Soil Erosion	■

7.1.3.2 Soil Contamination

As mentioned in Section 6.1.4 analysis of a possible historic soil contamination has been performed in August 2017, concluding that soil quality is in line with the general characteristics of the region and is within the national limits of permitted norms (Consecoard LLC 2017). For details and analysis results see Section 13.3 in the Annex. IFC/World Bank Group General EHS Guidelines (2007) state that the national limit parameters have priority, and only if no national parameters exist, other internationally recognized parameters shall be used.

Soil contamination during construction works can arise from improper waste disposal and accidental leakage from tanks of lubricants, solvents, paint, oil, diesel, chemicals, etc. Depending on the kind of the contaminant, soil can be polluted short- or long-term. Measures given in the ESMP to prevent pollution of soil by oil and chemical spills have to be implemented during construction phase.

Impact of/ on	**Extent of Impact (after Mitigation)**
Soil Contamination	■

7.1.4 Water Resources

7.1.4.1 Surface Water

The nearest water body to the construction site is Artashati Jrants Canal, located about 700 m to the south east. The Hrazdan River is located at least 5 km away from the construction site. Thus, surface water is not expected to be influenced during the construction period.

Impact of/ on	**Extent of Impact (after Mitigation)**
Surface Water	o

7.1.4.2 Groundwater

Operation of workers' camps during the construction period will not be necessary, as local workforce from Yerevan will be employed who can return to their homes daily, and those from other cities/abroad will be lodged in RENCO's guesthouse or hotels. However, during construction period toilets and sanitary rooms will have to be provided for the workforce at the construction site, separately for men and women and according to

IFC/ EBRD Guidance Note[21]. Sewage water shall be led to the sewage water system of the adjacent YCCPP-1 or septic tanks will have to be used for collecting sewage water which then would have to be emptied by a specialized company from time to time.

Contamination of the soil can indirectly lead to a pollution of the groundwater. Groundwater contamination can e.g. arise from improper waste storage and accidental leakage from tanks of lubricants, solvents, paint, oil, diesel, chemicals, etc. Depending on the kind of the contaminant, the groundwater may be polluted short or long term. Measures given in the ESMP to prevent pollution of groundwater by oil and chemical spills have to be implemented during construction phase.

An effective mitigation strategy to prevent pollution of the groundwater at the construction sites is to enforce a Waste Management Plan (see Section 7.1.7). Storing of construction material and any kinds of waste outside defined places shall be prevented and potential pollutants shall be handled properly. The impact magnitude is expected to be low when applying the identified mitigation measures.

An evaluation is currently ongoing regarding a possible lowering of the groundwater level for 2-3 m at the construction site during construction period, or permanently also during operation by a drainage system. According to the groundwater analysis study (Consecoard, 2017) the drained groundwater could be directed to the downstream area of Hrazdan River without additional cleaning, as the results of all sampling tests were within the limits of the 5th grade of water quality, which conforms to the water quality of Hrazdan River (see Section 13.3. in the Annexes).

If the groundwater level will be lowered, an additional impact assessment including the development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.

Impact of/ on	**Extent of Impact (after Mitigation)**
Groundwater level lowering	■■ (still unknown)
Groundwater contamination	■

[21] see IFC/ EBRD Guidance Note on Workers' Accommodation (2009)

7.1.5 Climate and Air Quality

Dust generation from transportation and construction activities as well as emissions from vehicles and construction machinery will be the main impacts on air quality during the construction phase of the proposed Project.

During construction activities dust particles can be swirled up resulting in a visible dust deposition close to the construction activities. Dust generation and distribution is dependent on weather conditions, wind speed, precipitation rate, as well as type and extent of construction activities. Dust deposition under low precipitation rates and high temperatures will be much higher than under wet conditions.

The main sources of dust emissions during construction are site clearing, site excavation and other earthworks as well as movement of construction vehicles.

During construction, the proposed project will lead to an increase in overall traffic flows for a limited period, which will cause a rise in vehicular emissions. These emissions together with exhaust emissions from construction machinery are likely to result in marginal increases in the emissions of SO_2, NO_X, CO, CO_2, and unburned hydrocarbons (UHC).

Due to the limited duration of the construction period and implementation of mitigation measures, the impact on air quality during construction can be considered as low.

Impact of/ on	**Extent of Impact (after Mitigation)**
Climate and Air Quality	■

7.1.6 Landscape and Visual Aspects

The construction site is located in a highly industrialized area in southern Yerevan. Here, the existing YCCPP-1, chemical plants, metal factories and other industrial infrastructure dominate the landscape. During construction activities heavy construction machinery will be working at the site producing dust (e.g. due to excavation works) and thus representing a visual impact. The construction of the new power plant will add further highly visible structures (e.g. stacks and buildings) to the Project Area. However, due to the already existing industrial infrastructure in the area, the construction of YCCPP-2 will not enhance the contrast between the industrial site and the surrounding areas significantly.

Impact of/ on	**Extent of Impact (after Mitigation)**
Landscape and Visual Aspects	■

7.1.7 Waste

The main waste types generated during construction works can be generally classified as follows:

- domestic wastes generated by the workers (e.g. paper, plastic, drink containers, food waste etc.)
- plant debris from clearance of the construction site
- excavated inert material
- excavated contaminated material (e.g. soil polluted by fuel, engine oil and lubricants, and historically contaminated soil), if any
- construction waste (e.g. unused/ unusable construction material, wood from framework, maintenance waste, packaging material, empty containers etc.)
- hazardous waste like fuel, oils, paint, lubricants etc.

Waste Management Plan:

Possible impacts on soil and water can be prevented and mitigated by a professional handling and storage of hazardous substances and a proper handling of waste. The Construction Contractor (RENCO) shall develop a **Waste Management Plan** for the construction period that contains at least the following principles:

respecting the waste management hierarchy of avoidance, preparing for reuse, recycling as much as possible, recovery, and proper disposal of remaining waste according to EU Directive 2008/98/EC (Waste Framework Directive)
segregating all waste by category on site, based on their nature, and ultimate disposal sites
good technical planning in order to minimize the generation of construction waste
regular staff training to increase awareness of waste minimization issues and handling of different wastes.

A **Waste Management System** shall be implemented. In general, the generated construction waste shall be recycled as much as possible on site and the construction activities shall be controlled regularly. Storing of construction material, excavated soil and all kinds of waste outside defined places as well as throwing waste in open spaces shall be prevented.

Small amounts of hazardous waste like residual oil, fuel, paint or spill contaminated soil may accrue and shall be stored in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at the new YCCPP-2 site. All hazardous wastes shall be securely packed in sealed drums or other suitable containers, clearly identified by labels, and marked according to national and internationally recognized requirements and standards, including the International Chemical Safety Cards (ICSC), Materials Safety Data Sheets (MSDS), or equivalent. The final disposal of

hazardous waste is subject to medium to long term national-level solutions to be decided upon and provided by the Government of RA.

The Construction Contractor will have to establish an official agreement with municipal authorities, where the different types of waste may be disposed of, including using services of communal service providers for domestic waste disposal purposes during construction period.

During the site visit in July 2017 empty oil drums, scrap metal, old metal cabins, old changing rooms and wash basins and other material that has been disposed on the foreseen construction site of YCCPP-2 were found (see pictures below). All this material presently existing at the site has to be segregated and stored or disposed of accordingly before construction. There are also some concreted areas at the construction site which will have to be removed. Concrete waste can be disposed of at Yerevan dumping site or used as land filling material.

Figure 7-1: Scrap metal

Figure 7-2: Wooden and metal material

Figure 7-3: Metal cabin on concreted area

Figure 7-4: Old changing rooms and wash basins

If all mitigation measures given in the ESMP are implemented, including a Waste Management Plan as well as a Waste Management System, the impact from waste is rated as low.

Impact of/ on	**Extent of Impact (after Mitigation)**
Waste	■

7.2 Environmental Impacts during Operation Phase

7.2.1 Fauna, Flora and Biodiversity

Compliance with the performance guarantees for NO_X, CO and UHC will be achieved at the plant and monitored by a CEMS. Added to this, as no sensitive fauna and flora species occur in the Project Area the impact on these components derived from air emissions will be low.

Oily waste water flowing out of the new plant will be treated in an oil separator before discharging to the Hrazdan River using the existing discharge system of YCCPP-1. HRSG blow down and other drainage from steam/water system will be neutralized at the chemical shop of the power plant to meet the applicable water quality standards (see Table 7-1 below) and will then be discharged to the river. The utility sewerage will be connected to YCCPP-1 sewerage system. Thus, there will be only a low (if any) impact on aquatic organisms of the Hrazdan River.

Impact of/ on	**Extent of Impact (after Mitigation)**
Fauna and Flora	■

7.2.2 Protected Areas

As no Protected Areas or other sensitive areas like Ramsar Sites or Important Bird and Biodiversity Sites (IBA) are located near the Project Area, there will be no impacts from the operation of YCCPP-2 on any of these areas.

Impact of/ on	**Extent of Impact (after Mitigation)**
Protected Areas	o

7.2.3 Soil

Soil contamination can be possible due to spillages from oil/ fuel/ paint/ chemicals used during operation of the power plant. However, if the mitigation measures given in the ESMP (like correct storage and handling of those items; use of spill-fighting materials, etc.) are implemented, the impact is rated low.

Impact of/ on	**Extent of Impact (after Mitigation)**
Soil Contamination	■

7.2.4 Water Resources

7.2.4.1 Surface Water

Water supply during operation of the YCCPP-2 will be branched from the existing water pipelines which are serving the YCCPP-1. All water will be taken from the Yerevan potable water grid and will be used for all civil utilities like cooking, drinking, etc. It will also be used as process water which is connected to the raw water storage tank and for all other uses (e.g. cooling tower make up, HRSG blow-down tank quench, firewater tank and network, utility water network, etc.). The maximum power plant water flow rate (referred to normal operation) will be 450 m³/h (annual average). The necessary average monthly water quantity will be around 300,000 m³. According to RENCO the normal power plant flow rate which will be led to the drainage/ sewer system will be approx. 110 m³/h which means approx. 80,300 m³ per month.

The oily waste water coming from power plant operation will be duly collected and routed to a treatment plant (oil separator) before being discharged to recipient existing system of YCCPP-1. Treatment system will be suitably selected and implemented to meet the environmental limits (see Section 3.4) and the good industry practice. Rain water which may be potentially oily will be routed to the same system; other rain water collected from the paved areas will be disposed to the existing discharge system leading to the Hrazdan River.

HRSG blow down and other drainage from steam/water system will be neutralized at the chemical shop of the power plant to meet the relevant water quality standards (see Section 3.4) and will then be discharged using the existing discharge system. The utility sewerage will be connected to the already existing YCCPP-1 sewerage system.

The Design Data of ArmPower (2017) define effluent conditions to be met for wastewater (see Section 3.4). IFC/World Bank Group EHS Guidelines for Thermal Power Plants (2008) describe effluent guidelines for the direct discharge of treated effluents to surface waters (see Section 3.4), where the given values shall be achieved without dilution at least 95% of the time that the plant or unit is operating. Design Data for YCCPP-2 comply with the IFC Guidelines.

The Ministry of Nature Protection has set up Effluent Standards for operation of the neighboring YCCPP-1. Allowed concentrations according to these standards are also given in Section 3.4 for comparison.

A monthly monitoring program shall be established to be performed e.g. by the “Environmental Monitoring and Information Center” SNCO in order to guarantee the adherence of all wastewater, sanitary water and drainage water to the **most stringent of these limit values**.

Additionally, there is a low risk of pollution of surface water by fuel and lubricants from machinery and vehicles, which can be avoided by proper maintenance. Additionally, oil/ fuel/ paint/ chemicals used during operation could pollute surface waters. However, if all mitigation measures given in the ESMP are implemented the impact is rated to be low.

Impact of/ on	**Extent of Impact (after Mitigation)**
Water Courses	■

7.2.4.2 Groundwater

Underground drainage water will not be used nor affected by plant operation.

An evaluation is currently ongoing regarding a possible lowering of the groundwater level for 2-3 m at the power plant's site permanently during operation by a drainage system. This underground collection system would divert the ground water from the footprint area of the plant to keep the foundations dry and to increase the seismic response and the foundation's life. This system would consist of holed pipes installed inside a gravel bed and conveying the water to a boundary location of the plant plot area. According to the groundwater analysis study (Consecoard, 2017) the drained groundwater could be directed to the downstream area of Hrazdan River without additional cleaning, as the results of all sampling tests were within the limits of the 5th grade of water quality which conforms to the water quality of Hrazdan River.

If groundwater level will be lowered, an additional impact assessment including the development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.

Contamination of the soil can indirectly lead to a pollution of the groundwater. Contamination can be possible due to spillages from oil/ fuel/ paint/ chemicals used during operation of the power plant. However, if the mitigation measures given in the ESMP (like correct storage and handling of those items; use of spill-fighting materials, etc.) will be implemented, the impact from contamination is rated low.

Impact of/ on	**Extent of Impact (after Mitigation)**
Groundwater level lowering	■■ (still unknown)

Impact of/ on	Extent of Impact (after Mitigation)
Groundwater contamination	■

7.2.5 Climate and Air Quality

Stack emissions:

During the operation of the new power plant the impact on atmospheric air is due to emissions of the outcome generated as a result of fuel combustion. IFC/World Bank Group EHS Guidelines for Thermal Power Plants (2008) describe emission levels for new thermal power plants. For combustion turbines using natural gas the NOx emissions shall be less than 51 mg/Nm³ (referring to dry exhaust and 15% O_2). In order to keep the emissions low a low-NOx burner will be used in the new YCCPP-2.

There are no Armenian air emission limits for thermal power plants. The specifications for YCCPP-2 demand compliance with the following Performance Guarantee values (ArmPower, 2017): NOx emissions equal or less than 50 mg/Nm³, CO emissions equal or less than 30 mg/Nm³ and UHC emissions equal or less than 10 mg/Nm³ (referring to dry exhaust and 15% O_2).

Greenhouse gas emissions are, according to RENCO, expected to be 785,000 t CO_2/year (considering 8350 OH at 12°C) and 371 g CO_2/kWh gross, respectively. This value is within the range of the typical CO_{2eq} emissions provided in the IFC/World Bank Group EHS Guidelines for Thermal Power Plants (CCGT with 51% efficiency: 396 g CO_2/kWh gross). These values are much lower than those of Power Plants fired by coal or oil. According to IFC Performance Standard PS 3 an annual quantification of greenhouse gas emissions shall be done for plants emitting more than 25,000 t CO_2/year, which is the case of YCCPP - 2. The quantification shall include direct and indirect emissions [22].

A Continuous Emissions Monitoring System (CEMS) will be installed at the stack of the new power plant. Adherence to the limit values shall be checked regularly e.g. by the "Environmental Monitoring and Information Center" SNCO.

The Draft Air Dispersion Calculation Report (ADC) (see Section 13.5 in the Annex) provides indicative results for the cumulative effects of air emissions of CO and NO_2 from the new power plant on the surrounding airshed:

[22] Indirect emissions refer to the off-site generation by otehr of electricity, and heating and colling energy used by the Project (IFC, 2012)

- The simulation of the 1 hour, 8 hour and 24 hours GLCs for CO shows that these are expected to be very low in all analyzed scenarios. All CO international and national air quality standards are foreseen to be fulfilled in the area. The maximum 1 hr, 8 hr and 24 hr GLCs of CO derived from the operation of YCCPP-2 represent less than 25% of all applicable air quality standards.
- The maximum modeled 1 hr and annual NO_2 GLCs are expected to be below the national and the international Air Quality Standards throughout the entire assessment area for all scenarios. The maximum modeled 24 hr NO_2 GLC is expected to be above the national MAC (max. allowable concentration) for Scenario C, i.e., the scenario that considers the cumulative effects of YCCPP-1 and YCCPP-2. However, it shall be noted that the national MAC for 24 hr NO_2 of 40 μg/m³ is very stringent, and corresponds to the ECD (European Council Directive) annual limit. The maximum modeled 1 hr and 24 hr GLC as a result of the operation of YCCPP-2 only (Scenario B) represent more than 25% of the applicable standards.

In summary, the indicative results of the ADC show that the national air quality standard for 24hr NO_2 may not be fulfilled in the area, when considering cumulative impacts. However, the applicable international standards are expected to be respected in all scenarios for all pollutants.

The ADC will be updated in a later stage, once the results of the baseline assessment are availble for all seasons.

Particulate Matter (PM) emissions from cooling towers:

The principal air pollutant emitted directly from wet cooling towers is small particulate matter (PM). Dissolved solids in the circulating water result in fine particulate emissions (PM_{10} / $PM_{2.5}$) when water droplets are ejected from the tower evaporate before they reach the ground. Cooling tower particulate emissions are controlled through the use of drift eliminators, which are shaped materials that collect small water droplets as they exit the tower. Design Data of ArmPower (2017) mention that the evaporative towers of YCCPP-2 shall be designed to have a low drift phenomena.

In order to reduce the emissions of particulate matter from the cooling towers during operation of the power plant, drift eliminators according to Good International Industry Practice (GIIP) shall be included in the design of cooling towers and raw water shall be filtered in order to reduce the content of Total Dissolved Solids (TDS). A baseline air quality monitoring was just undertaken by FICHTNER in August 2017 at the surroundings of the power plants' site which included the measurement of PM_{10}. Results show that PM_{10} concentrations (measured at different daytime periods) are clearly below the maximum permissible concentrations and the daily average concentration limits as set by RA Decree No. 160-N "Norms of maximum permissible concentrations of atmospheric air pollutants in residential areas". The international air quality standards for PM_{10} are also fulfilled.

Implementing all mitigation and monitoring measures as given in the ESMP, the impact of the Project on climate and air quality is rated at this stage as low.

Impact of/ on	Extent of Impact (after Mitigation)
Climate and Air Quality	■

7.2.6 Landscape and Visual Aspects

The Project Area is located in a highly industrialized area in southern Yerevan. Here, the existing YCCPP-1, chemical plants, metal factories and other industrial infrastructure dominate the landscape. The planned new power plant will add further highly visible structures (e.g. stacks and buildings). However, due to the already existing industrial infrastructure in the area, the realization of the project will not enhance the contrast between the industrial site and the surrounding areas.

Impact of/ on	Extent of Impact (after Mitigation)
Landscape and Visual Aspects	■

7.2.7 Waste

According to IFC/World Bank Group EHS Guidelines for Thermal Power Plants (2008) gas fired thermal power plants generate essentially no solid waste during operation because of the negligible ash content.

Domestic waste produced by the plant staff shall be collected in provided bins and picked up by a contracted waste collector for disposal at Yerevan dumping site.

Currently there are no suitable dumping sites for hazardous waste in Armenia. All hazardous waste shall be stored in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at new YCCPP-2 site for future disposal (see also Section 7.1.6).

In the Chemical Workshop of the new YCCPP-2 acids and alkaline solutions will be used for neutralization of HRSG blow down and other drainage from steam/water system in order to meet Armenian / IFC water quality standards (whichever is more stringent). These hazardous materials have to be adequately stored and used only by trained personnel using the adequate Personal Protective Equipment (PPE). Material has to be clearly labeled and marked according to national and internationally recognized requirements and standards, including the International Chemical Safety Cards (ICSC), Materials Safety Data Sheets (MSDS), or equivalent. Waste

material from these processes has to be stored accordingly as hazardous waste (see above).

Impact of/ on	Extent of Impact (after Mitigation)
Waste	■

7.3 Social Impacts during Construction Phase

7.3.1 Local Workforce

During the construction period local workforce (mainly unskilled workers) from the nearby villages and Yerevan shall be employed for the construction works. According to RENCO in peak construction times about 450 workers will be needed. This will contribute to much needed monetary income in the region. Special attention shall be laid on the recruitment of women, wherever possible. However, the income generation opportunity is not of long term duration, as it will be limited to the construction period.

RENCO SPA as the EPC Contractor has a systematic approach which fully complies with the international standards ISO 14001 and OHSAS 18001. RENCO has a Human Resources Policy in place. Thus it is assumed that a non-discriminatory hiring and wage policy according to IFC PS 2 (clearly stating that the company will not discriminate in hiring and salaries based on gender, age, religion, ethnicity or place of origin, etc.) is already in place.

Impact of/ on	Extent of Impact (after Mitigation)
Local Workforce	+

7.3.2 Land Usage and Ownership

There is no land use by the local population at the construction site, as the area has already been acquired by ArmPower CJSC, fenced, and foreseen for construction of YCCPP-2. Also, there are no houses or private assets located inside the construction site, so that no physical relocation or acquisition of further land will be necessary for this Project.

Impact of/ on	Extent of Impact (after Mitigation)
Land use	o

7.3.3 Historical and Cultural Sites

Within the construction site and the Project Area no cultural or historic sites are known. For the case of an unexpected encounter of Cultural and Historical Sites or Goods a **Chance Find Procedure** has to be implemented. In case of any chance finds, the construction has to be stopped immediately and the Agency of Protection of Historical and Cultural Monuments/ Ministry of Culture has to be informed to agree on further steps (as according to Armenian Law). The Chance Find Procedure will include:

- Stop the construction activities immediately in the area of the find.
- Notify the responsible local authorities and the Ministry of Culture.
- Evaluation of the findings to be performed by the archaeologists of the Agency of Protection of Historical and Cultural Monuments/ Ministry of Culture.
- Decision on how to handle the find to be taken by the responsible authorities and implementation of the decision concerning the management of the finding.
- Construction work could resume only after written permission is given from the responsible local authorities and the Ministry of Culture concerning safeguard of the heritage.

Impact of/ on	**Extent of Impact (after Mitigation)**
Historical and Cultural Sites	■ (if any)

7.3.4 Occupational and Community Health and Safety

7.3.4.1 Occupational Health and Safety

RENCO SPA will be the EPC Contractor for this Project. RENCO has a Health, Safety and Environment Policy (2015) in place, in order to meet the requirements, regulations and communities affairs for the health of all persons working under the control of RENCO, environment protection and plants safety. An integrated system for safety, environment and quality has been implemented in compliance to international guidelines and standards (like OHSAS 18001 and ISO 14001 standards).

For construction of YCCPP-2 a site-specific Health, Safety and Environment Management Plan (HSEMP) will be developed and a Health, Safety and Environment Management System (HSEMS) implemented during construction. An H&S manager of RENCO shall be on duty all the time during construction period. These HSEMP and HSEMS shall also be valid for any third parties or subcontractors in the supply chain.

The HSEMS shall include among others medical health care, proper sanitation installations and use of Personal Protective Equipment (PPE) such

as wearing of helmets and ear plugs when working under high noise levels, wearing of safety shoes, protection clothes, etc. The HSEMS shall explicitly include measures aiming at health and safety of the public. Construction workers shall be trained regarding in proper handling and storage of hazardous materials etc. Handling and storing materials involve diverse operations such as driving a truck; hoisting tons of steel with a crane; carrying bags or materials manually and stacking materials such as drums, iron parts, barrels, etc. Therefore, specially designated, logistically applicable lay-down areas will be set up inside the boundaries of the foreseen construction site.

To manage human exposure to electric and magnetic fields IFC PS and IFC/ WB EHS Guidelines for Electric Power Transmission and Distribution require respecting the limits established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - see Section 3.4.

Areas (if any) at the construction site and the adjacent new substation (which will be connected by overhead transmission line or underground cable to the new power plant), where high electric or magnetic fields occur, shall be signed. The exposure of workers has to be below the values given above. Workers have to be equipped with special Personal Protective Equipment (PPE) for working in these areas.

Skilled working personnel (partly from abroad) will be accommodated in RENCO's guesthouse or at hotels in Yerevan. Distance to the construction site is approx. 7 km. Local (mainly unskilled) workforce shall be employed from Yerevan and the adjacent villages. No workers' camps will have to be established as local workers will return to their home daily, and workers from abroad/other cities will be lodged in RENCO's guesthouse or hotels. Transfer to and from the construction site will be carried out by personnel private means or public transport, and in addition by means managed by the EPC Contractor.

Impact of/ on	**Extent of Impact (after Mitigation)**
Occupational Health and Safety	■

7.3.4.2 Community Health and Safety

Transporting construction equipment on trucks might be dangerous to residents, when trucks drive through residential areas or small villages. Thus, adequate security measures to prevent accidents and injury have to be taken (e.g. keeping speed limits, inform population along public roads in advance in case of transporting heavy equipment, etc.)

The construction site itself will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access to the

site, thus also minimizing possible impacts on community health and safety. Security arrangements shall be guided by principles of proportionality, good international practice[23] and Armenian national law and include training of security personnel regarding the use of force and conduct towards the community.

The new transmission line (overhead line or underground cable) connecting new YCCPP-2 with the high voltage substation just under construction, will be constructed mainly inside the properties of YCCPP-2 or the new substation, just crossing one road.

Emergency Preparedness and Response Plan

RENCO as EPC Contractor shall develop an **Emergency Preparedness and Response Plan** for the construction period that contains at least the following principles (according to IFC PS 1):

- Identification of areas where accidents and emergency situations may occur
- Identification of communities and individuals that may be impacted
- Establishment of response procedures
- Provision of equipment and resources
- Designation of responsibilities
- Communication with workers and the public
- Training of workers

RENCO shall also assist and collaborate with the potentially affected communities and local government agencies in their preparation to respond effectively to emergency situations. RENCO shall provide appropriate information to potentially affected communities and relevant government agencies. The emergency preparedness and response activities shall be periodically reviewed and revised, if necessary.

The impact on human health for the public during construction can be assessed to be low, if the mitigation measures of the ESMP are implemented.

Impact of/ on	**Extent of Impact (after Mitigation)**
Community Health and Safety	■

7.3.4.3 Noise

As stipulated in the General EHS Guidelines of IFC/ World Bank Group, '*no employee should be exposed to a noise level greater than 85 dB (A) for*

[23] e.g. UN Code of Conduct for Law Enforcement Officials,
UN Basis Principles on the Use of Force and Firearms by Law Enforcement Officials

a duration of more than 8 hours per day without hearing protection'. Construction workers will wear ear protection devices as part of their Personal Protective Equipment (PPE), if they are exposed to noise levels higher than 80 dB (A), according to Armenian legislation (see also Section 3-4).

Noise impacts to the public will be generated by operation of heavy equipment at the construction site and by an increased frequency of vehicular traffic in the area. However, these impacts are short term, intermittent and temporary in nature.

Residential areas in the vicinity of the site, which are located near to major roads, will be exposed to higher noise levels due to a greater volume of heavy truck traffic passing by on the main roads. Thus, truck movements shall only be allowed during daylight, but not between 7 pm and 6 am.

The overall impact of noise on the environment that is generated during construction of the plant is temporary only and mainly confined to daylight hours. It is anticipated that - with the measures outlined in ESMP - it will be possible to reduce noise impacts during construction to an acceptable minimum according to the most stringent limits (see Section 3-4).

Impact of/ on	**Extent of Impact (after Mitigation)**
Noise	■

7.4 Social Impacts during Operation Phase

7.4.1 Electricity Supply

Power demand in Armenia is constantly rising due to rapidly growing economy and a rising population. The Armenian Government is becoming more focused on financial support for projects that have nation-wide significance, are capable of ensuring an adequate level of energy security and independence, and can secure social and economic development (Government of Armenia, 2005). The new YCCPP - 2 is listed as one of the projects that shall support achieving these objectives.

The operation of YCCPP-2 with a guaranteed gross power output of 254 MW will increase the total output of electric energy, providing a more reliable power supply countrywide.

Impact of/ on	**Extent of Impact (after Mitigation)**
Electricity Supply	**++**

7.4.2 Occupational and Community Health and Safety

7.4.2.1 Occupational Health and Safety

The new power plant YCCPP-2 will be operated by ArmPower CJSC, which is a subsidiary company of RENCO SPA.

RENCO SPA has a Health, Safety and Environment Policy (2015) in place, in order to meet the requirements, regulations and communities affairs for the health of all persons working under the control of RENCO, environment protection and plants safety. An integrated system for safety, environment and quality has been implemented in compliance to international guidelines and standards (like OHSAS 18001 and ISO 14001 standards).

The implementation of the HSE management system assures a systematic control of safety and environment performances through a constant monitoring in order to improve the performances itself.

To meet these targets among others the following actions have been established:

- Provide a safe working environment to safeguard health of personnel and environment
- Prevent risk situation and hazard to the people, to the material and to the environment
- Prevent and protect in the field of safety and environment (incidents, damages pollution, etc.), under overall aspects managing all the activities in conformity with applicable laws and local regulations
- Provide adequate equipment and qualified personnel to match the requirements of the task
- Provide training, information and dialogue to our personnel
- Preparation of environmental and safety reporting in order to monitor the performance of each project site
- RENCO's responsibilities cover all people working under the RENCO control: consultants, suppliers, subcontractors, etc.

Among others RENCO SPA has also a Social and Cultural Heritage Policy (2016) as well as an Anti-Corruption Policy (2016) and a Code of Ethics in place.

The above mentioned policies and HSE management systems shall also be established at ArmPower CJSC as subsidiary company of RENCO SPA.

Impact of/ on	**Extent of Impact (after Mitigation)**
Occupational Health and Safety	■

7.4.2.2 Community Health and Safety

Performance Guarantees (ArmPower 2017) demand the guaranteed gaseous emissions described in Section 3.4. These limits comply with the IFC/World Bank Group EHS Guidelines for Thermal Power Plants (2008). There are no national air emission limits for thermal power plants.

The Draft Air Dispersion Calculation (see Section 13.5 in the Annex) presents indicative results of the simulation of the cumulative impact of the YCCPP-2 on the surrounding airshed. These indicative results show that the national air quality standard for 24hr NO_2 may not be fulfilled in the area. However, the applicable international standards are expected to be respected. The ADC will be updated in a later stage, once the results of the baseline assessment are availble for all seasons.

Emission of particulate matter (PM_{10} / $PM_{2.5}$) from cooling towers will be reduced by including drift eliminators according to Good International Industry Practice (GIIP) in the design of cooling towers and filtering of raw water in order to reduce the content of Total Dissolved Solids (TDS).

The area of the new power plant will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access to YCCPP-2 site. Security arrangements shall be guided by principles of proportionality, good international practice and Armenian national law and include training of security personnel regarding the use of force and conduct towards the community.

The new transmission line (overhead line or underground cable) connecting new YCCPP-2 with the high voltage substation just under construction, will run nearly completely inside the properties of YCCPP-2 or the new substation, crossing one road.

Emergency Preparedness and Response Plan

ArmPower as Operator of YCCPP-2 shall develop an **Emergency Preparedness and Response Plan** for the operation phase, based on the emergency preparedness and response activities already implemented during construction phase of the project. The plan shall contain at least the following principles (according to IFC PS 1):

- Identification of areas where accidents and emergency situations may occur
- Identification of communities and individuals that may be impacted
- Establishment of response procedures
- Provision of equipment and resources
- Designation of responsibilities
- Communication with workers and the public
- Training of workers

ArmPower shall also assist and collaborate with the potentially affected communities and local government agencies in their preparation to respond

effectively to emergency situations. ArmPower shall provide appropriate information to potentially affected communities and relevant government agencies. The emergency preparedness and response activities shall be periodically reviewed and revised, if necessary.

If the mitigation measures given in the ESMP will be implemented the impact on public health and safety will be low.

Impact of/ on	**Extent of Impact (after Mitigation)**
Community Health and Safety	■

7.4.2.3 Noise

Noise levels will have to be measured regularly during operation phase of the new power plant and their compliance with Performance Guarantees (see Section 3-4) will have to be monitored.

YCCPP-2 has been designed with particular attention to limit the noise emissions. The most relevant noise sources will be located inside soundproofed cabins/ buildings to minimize noise propagation.

A Noise Propagation Study is available in Annex 13.4 and includes a Noise Calculation for the new power plant (YCCPP-2) site. The Noise Calculation has been done by using the propagation model SoundPlan. The model determines sound propagation based on the provisions of ISO 9613. This model is widely used in EU noise mapping projects. Application of this model allows determining whether the noise levels emitted by the new plant will represent a nuisance to the surrounding areas, i.e., if the resulting ambient noise will be above the national and international standards.

The calculation outcomes of the model for YCCPP-2 have shown that the operation of **the new plant will not produce any significant increase of the noise pressure at the sensitive receptors**. In particular:

- where the current noise pressure is under the applicable limits, the YCCPP-2 operation will not produce any exceedance of the said limit either during the daytime or during the night time;
- where the current noise pressure is already over the applicable limits, the YCCPP-2 will produce a negligible contribution.

As last consideration, it has to be underlined that, although at the YCCPP-2 fence no sensible receivers are present, the sound level contribution of the plant will be significantly below the applicable industrial areas noise limits.

Under implementation of the mitigation measures given in the ESMP the impact of noise generated during operation of YCCPP-2 is at the moment rated to be low.

Impact of/ on	Extent of Impact (after Mitigation)
Noise	■

7.4.3 Job opportunities

During operation phase the workforce is estimated by RENCO to be approx. 120 people comprised of administration, and operation and maintenance staff on roster working shifts. Most jobs during operation of YCCPP-2 will be for specialized workers (electrical engineers, automation and control engineers, mechanical engineers, etc.) which will require specific power plant training and will not be readily found in Armenia, with exception of personnel presently operating at similar plants (e.g. YCCPP-1). These personnel would also require some retraining to adapt to the new facilities. A few simpler jobs (e.g. food supply, housekeeping, etc.) however, will also be available for people which shall be employed from the adjacent residential areas (if possible) in order to create some additional income. Special attention shall be laid on the recruitment of women.

Impact of/ on	Extent of Impact (after Mitigation)
Job opportunities	+

7.5 Summary of Impacts

Assessment of environmental and social impacts, after implementation of the mitigation measures presented in the ESMP, is given in the following tables.

Table 7-1: Summary of impacts during construction phase

Impact of/on	Extent of Impact on/by
Fauna, Flora and Biodiversity	■
Protected Areas	o
Soil Use and Soil Erosion	■
Soil Contamination	■
Surface Water	o
Groundwater level lowering	■■ (still unknown)
Groundwater contamination	■
Climate and Air Quality	■
Landscape and Visual Aspects	■
Waste	■
Local Workforce	+
Land Use and Ownership	o
Historical and Cultural Sites	■ (if any)
Occupational Health and Safety	■
Community Health and Safety	■
Noise	■

Extent of impact:

■■■	=	high
■■	=	medium
■	=	low
o	=	nil
+	=	locally positive
++	=	regionally positive

Table 7-2: Summary of impacts during operation phase

Impact of/on	Extent of Impact on/by
Fauna, Flora and Biodiversity	■
Protected Areas	o
Soil Contamination	■
Water Courses	■
Groundwater level lowering	■■ (still unknown)
Groundwater contamination	■
Climate and Air Quality	■
Landscape and Visual Aspects	■
Waste	■
Electricity Supply	++

Impact of/on	Extent of Impact on/by
Occupational Health and Safety	■
Community Health and Safety	■
Noise	■
Job opportunities	+

Extent of impact:

■■■	=	high
■■	=	medium
■	=	low
o	=	nil
+	=	locally positive
++	=	regionally positive

In conclusion, from the results of the impact assessment it can be seen that the environmental and social impacts will be low or medium, if all proposed mitigation measures of the ESMP are implemented. Positive impacts are related to creating of job opportunities especially during construction. The additional power generation will increase the total output of electric energy, providing a more reliable power supply countrywide.

8. Information Disclosure, Consultation, and Participation

This chapter describes shortly the stakeholder meetings held by FICHTNER during the site visit in July 2017 and provides an overview about the requirements for disclosure of the ESIA study to the public and performing of Public Consultation meetings, where stakeholders and Project Affected People (PAP) can give their feedback and concerns regarding the ESIA study and the implementation of the Project.

A Draft SEP (Stakeholder Engagement Plan) providing further details is presented as an Annex (Section 13.6) to this ESIA Report.

During the site visit in July 2017 FICHTNER's environmental and social specialists performed stakeholder meetings with mayors of the adjacent villages Kharberd and Ayntap, with the Heads of Departments of Erebuni and Shengavit Administrative Districts, with the Environmental Monitoring and Information Center, with the Environmental Department of the Municipality of Yerevan, and with the NGO Aarhus Center [24](for a record of the meetings see Section 13.1).

The mayors of the villages Kharberd and Ayntap had no concerns regarding the implementation of the Project. No medical/ health issues of local population concerning the operation of existing YCCPP-1 were reported. As both villages suffer under a high unemployment rate (> 70%) the mayors hope that the Project will create jobs for the local population. These statements have also been supported during the discussions with the Heads of Departments of Erebuni and Shengavit Administrative Districts.

The Final Draft version of the ESIA, including the ESMP, will be disclosed to the public in English and Armenian versions. Interested people shall have real access to the documents, which shall therefore not only be posted on ArmPower's website, but shall also be delivered in printed copies to the local administration offices; advertisements in local media about their availability shall be made. Also Aarhus Center shall receive printed copies and ensure their sharing to the representatives of civil society organizations.

ADB's and IFC's policies require that once draft ESIA report is disclosed, sufficient time is allowed for stakeholders to get acquainted with the document prior to participating in a consultation meeting or otherwise communicating their feedback. According to national Armenian requirements the disclosure period is only 7 days, but disclosure of the documents for at least two weeks is recommended.

After disclosure of the documents, public consultation meeting(s) on the ESIA will be held. Consultation meeting(s) shall concentrate on interpreting

[24] Aahrus Center Yerevan is a NGO that promotes public participation in environmental/ social decision making processes and in managing activities of upcoming projects.

the ESIA report to the stakeholders and seeking their feedback and concerns, which will then be used as an input for in the revision of the Final Draft ESIA report.

ArmPower shall ensure that all public consultations are culturally sensitive. This means that the consultation shall include representation of the public (incl. women, youth, and vulnerable groups).

Various NGOs, including the Aarhus Center will be invited to the public consultations meeting. The Aarhus Center shall help to identify relevant NGOs and ensure sharing of information/ studies.

According to ADB's Safeguard Policy Statement (2009) and ADB's Public Communication Policy (2011) a draft environmental impact assessment (EIA) report for an environment category A project, shall be disclosed for at least 120 days on ADB's website before Board consideration. IFC's Sustainability Framework (IFC 2012) requires a disclosure of 60 days for a category A project.

For further details see the Draft Stakeholder Engagement Plan in Section 13.6.

9. Grievance Redress Mechanism

9.1 General Public Grievance Mechanism

In the course of the construction process, Project Affected People (PAP) may feel treated unjustly. This might happen for various reasons such as: the contractor does not adhere to sound construction principles, misunderstandings have arisen, or disagreement with procedures of consultation or notification. If this happens people shall be encouraged to lodge their complaints in a timely and effective manner without directly addressing the court, i.e., through a grievance mechanism.

All PAP will be notified about the Grievance Redress Mechanism (GRM) of the YCCPP -2 Project during the Public Consultation meetings, as well as through the disclosed project information leaflets. Contact data of the **ArmPower's Grievance Coordinator (GC)**, part of the **Grievance Committee**, will be disclosed.

During consultation the PAP shall be notified orally or in a written form about their rights and the procedure of filing complaints. Local NGOs, e.g. the local Aarhus Centre, can inform communities about the possibility to raise complaints and how and where to address them. The grievance mechanism has to be locally implemented at the level of village institutions and local self-government, as well as bundled on national level at ArmPower.

Grievances can be addressed at the local community level ('marzpet'), where the grievance will be recorded and forwarded to ArmPower's GC. Grievances that are addressed to the EPC Contractor during the execution of civil works shall also be forwarded to ArmPower's GC. Even if the constructor decides to settle the grievance on the spot, the documentation of the grievance settlement procedure needs to be prepared by ArmPower's GC.

All project related complaints can in addition be directly addressed to ArmPower's GC via phone, e-mail or grievance form (the SEP presents an example of the public grievances form). A project grievance hotline shall be made available by ArmPower for direct complaints (at national level), and all received grievances shall be recorded in a grievance log-book.

The ArmPower GC then decides whether to settle directly, to arrange a meeting with the Grievance Committee, or go to court. The decision has to be taken within 15 days. In case of major grievances that cannot be directly settled, permanent and non-permanent members of the Grievance Committee will be called for a meeting.

In case of failure of the grievance redress system, the PAP can submit their case to the appropriate court of law.

The EPC Contractor is obliged to carry out the work in accordance with the contractual requirements that include:

- Nominate a person of staff responsible for the reception and handling of grievances;
- Preparation of regular monitoring reports including details of any complaints that arose and how they were handled;
- If vulnerable affected people are identified, then the contractor will appoint professional advocates (social workers/legal experts) to assist those people during the entire process, and to act as independent advocates for them should any grievances arise;
- Arbitration of grievances with ArmPower and PAP.

ArmPower will carry out works that include:

- Nominate a person of staff responsible for grievance procedure coordination, hereby referred to as Grievance Coordinator (including first contact, periodical site visiting of mitigation measure to be implemented by contractor);
- A telephone line, e-mail address and contact name on project boards;
- Arbitration of grievances with contractor and PAP.
- Liaison with court.

The PAP have the option to choose a different representative, or directly liaison with ArmPower' staff responsible for grievance redress. Vulnerable households will have the support of their individual social worker and legal support, if applicable.

NGOs, e.g. Aarhus Centre or local member organizations will monitor grievance redress negotiations, assist with grievance arbitration, and raise public awareness. PAP need to be informed that in case of conflict with the community leader they can address NGO staff to follow up their complaint. NGOs will monitor the relationship between PAP and the community leader.

The aggrieved person (PAP) is encouraged to proceed in the following way:

a) Contact contractor's designated grievance staff in the following way: in person via the designated telephone number, via email, via regular mail. Alternatively, the PAP can contact their community leader, who would convey their grievance to the contractor's designated grievance staff.
b) Lodge a complaint and provide information on the case. Each complaint will be registered and a tracking number will be assigned to it. Responses to all complaints should be provided within 15 days (or 25 days in cases where complaint resolution requires special efforts).
c) Agree with the contractor on a mitigation measure.
d) Agree with the contractor on time limit for grievance settlement. Grievances have to be settled within two weeks, or otherwise specified in scheduled agreement.

e) Sign if the mitigation measure has been implemented as agreed
f) Seek redress from ArmPower if not satisfied with the above mentioned procedure though the designated telephone numbers, in person, or via email or regular mail. ArmPower should register all grievances and provide response within 15 days.
g) Involve appropriate NGOs
h) Seek redress from court if all else fails.

Although the grievance mechanism is designed to avoid lengthy court procedures, it does not limit the citizen's right to submit the case straight to the court of law.

ADB/ IFC are not directly a part of the Grievance procedure but shall receive reports about which complaints were received and how they have been followed up/ mitigated.

Special consideration has to be taken for vulnerable people as complaint mechanisms may be unusual and contact with legal procedures let alone courts of law may appear uninviting. This would prevent the most disadvantaged persons from addressing their grievance. A close monitoring on a village level by an independent social expert during the implementation of the project and a personal contact with PAP is therefore recommended.

Vulnerable PAP (all households below the poverty line) will be entitled to a legal aid/ social worker to support them with complaints procedures.

9.2 Workers Grievance Mechanism

The EPC Contractor RENCO and the future operator of YCCPP-2 ArmPower are requested to implement an independent grievance management system to enable the workers (and their organizations, where they exist) to raise reasonable workplace concerns. This includes complaints related to non-compliance with Health & Safety matters, discrimination cases and non-consideration of equal opportunities.

The workers grievance mechanism shall follow the same principles as the one created for the general public: complaints must be answered in a timely and effective manner without fear of retribution; the access to the grievance mechanism shall not replace or impede the subsequent access to other redress mechanisms; the promoter will inform workers of the grievance mechanism at the time of hire and make it accessible to them.

The grievance management system shall consider the possibility to contact directly a member of the Site Management Staff. The contacted staff members must take a note of the reported complaint or non-compliance and must report it to the Site Manager.

The Site Manager is requested to solve the complaint or non-compliance within 3 working days. In case the problem cannot be solved an action procedure specifying the needed activities together with a predicted deadline

for resolution of the problem must be prepared and submitted to the general manager.

The EPC Contractor and ArmPower are requested to provide as well the possibility for the workers to notify a complaint or non-compliance in a confidential way.

According to RENCO SPA a grievance mechanism for workers will be established for this Project, as it has been done in other international projects before. The system will allow staff and contractors to provide feedback on any element of the work via email or by hand delivery to a box placed on site. Grievances will be logged into a spreadsheet where they will be then delegated to the appropriate person for close out. Grievances will be confidential and staff and contractors will be in no way penalized for providing their feedback.

10. Environmental and Social Management Plans (ESMPs)

The negative environmental and social impacts of the Project that are described in Chapter 7 can be avoided, minimized or mitigated by performing suitable measures.

This chapter deals with the concrete mitigation measures (Section 10.1) and the monitoring measures (Section 10.2) to be taken during the construction and operation phases of YCCPP-2. It summarizes the anticipated environmental and social impacts and provides details on the measures; responsibilities to mitigate these impacts; the costs of mitigation; and the ways in which implementation and effectiveness of the measures will be monitored and supervised.

Compliance of the Project with IFC Performance Standards (PS) after implementation of the mitigation and monitoring measures given in the ESMPs is analyzed in Section 10.5.

An Environmental and Social Action Plan (ESAP) is presented in Section 10.6 in order to highlight the most urgent steps for implementation of the mitigation measures given in the ESMP, according to the relevant IFC Performance Standards and/or international guidelines and standards.

10.1 Mitigation Measures

10.1.1 Mitigation Measures for the Construction Phase

Table 10-1: Summary of Mitigation Measures during Construction Activities concerning Fauna and Flora

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Impacts on Fauna and Flora		
Mitigation measures (considering IFC PS 6 and General EHS Guidelines)	**Responsible Party**	**Budget for implementing (USD)**
Prohibition of pesticides for site clearance (use mechanical process only)	EPC Contractor	Included in construction costs
Mitigation measures to be implemented to reduce risks of soil and water contamination also mitigate the impact on flora and fauna		
Mitigation measures to be implemented to noise reduction like using low sound power mechanical equipment also mitigate the impact on noise sensitive fauna		
Dust generated by construction works (e.g. excavation works) shall be suppressed by spraying water		

Table 10-2: Summary of Mitigation Measures during Construction Activities concerning Erosion Control

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Erosion		
Mitigation measures (considering IFC PS 3 and General EHS Guidelines)	**Responsible Party**	**Budget for implementing (USD)**
Minimization of the area of construction site and material storage	EPC Contractor	Included in construction costs
Minimize removing topsoil at construction site and store in line with international good practice, so that it can be re-used after construction		
Protect excess spoils, if any, from runoff		
Excess spoil and soil, if any, will be left in orderly piles, covered with topsoil, and re-vegetated with native species		

Table 10-3: Summary of Mitigation Measures during Construction Activities concerning Soil Pollution

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Soil pollution		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guidelines: Waste Management, Hazardous Material Management)	**Responsible Party**	**Budget for implementing (USD)**
Regular maintenance of all vehicles and machines at regular service stations, if possible	EPC Contractor	Included in construction costs
Maintenance and re-fueling of the construction equipment only on sealed and enclosed areas		
In case of any spillage: Localization of the spilled material and immediate cleaning of the contaminated area in order to prevent the pollutant from entering soil		
Store all liquid materials (e.g. fuel, engine oil, paint, chemicals, lubricants, etc.) in locked tanks and on sealed, bunded and roofed areas		
Store construction material (bags of cement etc.) in containers in order to avoid rinsing out		
Train transporters and workers in spill prevention and control especially in handling of oil and fuel		
Provide spill-control materials to drivers and workers, in order to clean up spills, if necessary		
Report and respond to spills promptly and train workers in how to report		
Remove contaminated soil if spills occur and handle as hazardous waste		

Table 10-4: Summary of Mitigation Measures during Construction Activities concerning Water Pollution

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Water pollution, Sanitary risk		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	**Responsible Party**	**Budget for implementing (USD)**
Mitigation measures given in Table 10-3 (Soil Pollution) will also reduce the risk of water pollution	EPC Contractor	Included in construction costs
Construction site has to be equipped with toilets and sanitary rooms according to IFC/ EBRD Guidance Note[25] - separately for men and women; lead sewage water to sewage water system of adjacent YCCPP-1 or use septic tanks for collecting sewage water, which have to be emptied by a specialized company from time to time.		
Train workers in appropriate sanitation practices		
Provide waste bins at the construction site in order to collect workers' waste (implement Waste Management Plan)		
If a lowering of the groundwater level at the construction/ plant site will be performed, an additional impact assessment including development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.		

Table 10-5: Summary of Mitigation Measures during Construction Activities concerning Climate and Air Quality

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Air Quality and Climate Change		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guideline: Air Emissions and Ambient Air Quality)	**Responsible Party**	**Budget for implementing (USD)**
Reduction of speed to 20 km/h within the construction site and optimization of the movement of vehicles	EPC Contractor	Included in construction costs
Optimize transportation management to avoid needless truck trips		
Maintain vehicles and construction machinery properly maintained, as recommended by suppliers		
Cover truck beds with tarps during material transport		
Use dust-suppressing water spray during civil works, where necessary		
Store and handle material appropriately to limit dust (e.g. protect cement with tarpaulins)		

[25] see IFC/ EBRD Guidance Note on Workers' Accommodation (2009)

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Air Quality and Climate Change		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guideline: Air Emissions and Ambient Air Quality)	**Responsible Party**	**Budget for implementing (USD)**
Avoid unnecessary idling of construction machines and vehicles	EPC Contractor	Included in construction costs

Table 10-6: Summary of Mitigation Measures during Construction Activities concerning Landscape and Visual Aspects

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Landscape and Visual Aspects		
Mitigation measures (considering General EHS)	**Responsible Party**	**Budget for implementing (USD)**
Use dust-suppressing water spray during civil works, where necessary	EPC Contractor	Included in construction costs
Clear up the construction waste and remove all machinery after construction works		
Reinstate any adjacent damaged areas		

Table 10-7: Summary of Mitigation Measures during Construction Activities concerning Waste Management

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks from Waste		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	**Responsible Party**	**Budget for implementing (USD)**
Collect and segregate all type of wastes. EPC Contractor will agree with municipal authorities about using services of communal service providers for waste disposal purposes.	EPC Contractor Local authorities	Included in construction costs
Development of a Waste Management Plan (as part of the site specific HSE Management Plan) containing the following principles: (I) respecting the waste management hierarchy of avoidance, preparing for reuse, recycling as much as possible, recovery, and proper disposal of remaining waste according to EU guideline 2008/98/EC; (II) segregating all waste by category on site, based on their nature, and ultimate disposal sites; (III) good technical planning in order to minimize the generation of construction waste; (IV) regular staff training to increase awareness of waste minimization issues and handling of different wastes.	EPC Contractor	Included in construction costs
Implementation of a Waste Management System	EPC Contractor	Included in construction costs
Store all hazardous waste (e.g. oil, fuel, paint, spill contaminated soil) in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) for future disposal		
Pack all hazardous wastes securely in sealed drums or other suitable containers, clearly identify them by labels, and provide Materials Safety Data Sheets (MSDS)		
Train workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste		
Presently existing waste material at the construction site (e.g. empty oil drums, scrap metal, old cabins, old changing rooms and wash basins, etc.) has to be segregated and stored or disposed of accordingly. Concrete waste can be disposed of at Yerevan dumping site or be used as land filling material		

Table 10-8: Summary of Mitigation Measures during Construction Activities concerning Historical and Cultural Sites and Goods

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Historical and Cultural Sites and Goods		
Mitigation measures (considering IFC PS 8 and General EHS-Guideline)	**Responsible Party**	**Budget for implementing (USD)**
Implementation of Chance Find Procedure (see Section 7.3.3) and training of the construction workers	EPC Contractor	Included in construction costs
Report chance finds immediately to RA Ministry of Culture, Dep. Protection of Monuments and Historical Sites		

Table 10-9: Summary of Mitigation Measures during Construction Activities concerning Occupational Health & Safety

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Workers' Health and Safety		
Mitigation measures (considering IFC PS 1, PS 2, General EHS-Guideline and EHS-Guidelines: Occupational Health and Safety)	**Responsible Party**	**Budget for implementing (USD)**
EPC Contractor shall develop and implement a site-specific Health, Safety and Environment Management Plan (HSEMP) for the construction phase	EPC Contractor	Included in construction costs
EPC Contractor shall develop and implement a Health, Safety and Environment Management System (HSEMS) for construction phase. An H&S manager of EPC Contractor shall be on duty all the time during construction period.		
These HSEMP and HSEMS shall also be valid for any third parties or subcontractors in the supply chain		
Make sure that all workers have a health insurance		
Awareness raising regarding sexually transmitted diseases (STD) should be provided to workforce		
Consider possible occurrence of venomous snakes during working (train the workers on venomous species identification and bite handling, provide related first aid equipment).		
For workers noise levels shall be kept below 80 dB (A), wherever possible. Hand out ear protection devices to all workers, when necessary. According to WB/IFC General EHS Guideline, workers are obliged to wear ear protectors where 85 dB (A) are exceeded for a duration of more than 8 hours.		
Provide workers with appropriate protective equipment (PPE) according to RENCO's Occupational Health & Safety Standards		
Train workers accordingly regarding work at heights, electrical and vehicular safety, handling of hazardous materials, PPE, hazard avoidance and reduction measures, use of first aid and rescue techniques, emergency response, etc.		
Forbid alcohol and other drugs at the construction site		
Assure transfer of injured workers to hospitals in the case of serious accidents		
Identify area emergency responders, hospitals, and clinics		
Limit occupational exposure to electric or magnetic fields (EMF) by use of shielding materials, signing of relevant areas and training of workers		
Licensing and training of drivers; improvement of driving skills		
Training and licensing industrial vehicle operators in the safe operation of specialized vehicles, including safe loading/ unloading, and load limits	EPC Contractor	Included in construction costs

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Workers' Health and Safety		
Mitigation measures (considering IFC PS 1, PS 2, General EHS-Guideline and EHS-Guidelines: Occupational Health and Safety)	**Responsible Party**	**Budget for implementing (USD)**
Maintain vehicles regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure		
Record work-hours as well as all accidents and incidents		
Skilled working personnel (partly from abroad) will be accommodated in RENCO's guesthouse or at hotels in Yerevan. Local (mainly unskilled) workforce shall be employed from Yerevan and the adjacent villages. No workers' camps will have to be established as local workers will return to their home daily		
Transfer of workers to and from the construction site shall be managed by the EPC Contractor (e.g. bus transfer)		
Implement and communicate an accessible grievance mechanism for workers to address any complaints		

Table 10-10: Summary of Mitigation Measures during Construction Activities concerning Community Health & Safety

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Public Health and Safety		
Mitigation measures (considering IFC PS 1, PS 4, General EHS-Guideline and EHS-Guidelines: Community Health and Safety)	**Responsible Party**	**Budget for implementing (USD)**
Optimization of transportation management to avoid needless truck drives	EPC Contractor	Included in construction costs
Allow truck movements only during daylight, but not between 7 pm and 6 am		
Reduce vehicle speeds (stick to recommended speeds) in populated areas to avoid noise		
Use of machines with low sound power and fitting of construction machines with silencers or mufflers		
Regular maintenance and service of building machinery and other vehicles during construction works		
Shut down or throttling down of noisy machinery to a minimum		
For residents the noise levels may not exceed 50 dB (A) during daytime and 45 dB (A) during night. According to WB/IFC General EHS Guideline, noise level for residents may not exceed 55 dB (A) or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site.		
The construction site itself will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access to the site, thus also minimizing possible impacts on community health.		
Security arrangements to be guided by principles of proportionality, good international practice and national law		
Security personnel shall be trained regarding the use of force and conduct towards the community		
Provide adequate security measures to prevent accidents and injury (e.g. keeping speed limits on public roads)		
Inform population of small villages along public roads in advance, in case of transporting heavy equipment		
Establish worker code of conduct to help prevent friction or conflict with communities		
Develop and implement an Emergency Preparedness and Response Plan (see Section 7.3.4)		
Provide appropriate information about the Emergency Preparedness and Response Plan to potentially affected communities and individuals		

Table 10-11: Summary of Mitigation Measures during Construction Activities concerning Social Aspects

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Social Aspects		
Mitigation measures (considering IFC PS 2, General EHS-Guideline and EHS-Guideline: Occupational Health and Safety)	**Responsible Party**	**Budget for implementing (USD)**
Develop and implement a non-discriminatory hiring and wage policy (clearly stating that the company will not discriminate in hiring and salaries based on gender, age, religion, ethnicity or place of origin), if not already in place	EPC Contractor	Included in construction costs
Prosecute offenses related to payment of wages by sub-contractors strictly		
Prioritize employment of local people for construction works (offer job opportunities in nearby villages and Yerevan)		
Improve recruitment of women for construction works		
Zero tolerance for sexual harassment at the work place		
Implement and communicate an accessible grievance mechanism for PAP to address any complaints		
If a lowering of the groundwater level at the construction/ plant site will be performed, an additional impact assessment including development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.		

10.1.2 Mitigation Measures for the Operation Phase

Table 10-12: Summary of Mitigation Measures during Operation concerning Protection of Flora and Fauna.

Mitigation measures to be applied during operation		
Issue for Mitigation: Flora and Fauna		
Mitigation measures (considering IFC PS 6, General EHS Guidelines and EHC Guideline: Thermal Power Plants)	**Responsible Party**	**Budget for implementing (USD)**
Oily waste water from power plant will be led to an oil-separator before entering the discharge system leading to Hrazdan River	ArmPower	Included in operational costs
HRSG blow down and other drainage from steam/water system will be neutralized at chemical shop to meet relevant water quality standards and will then be discharged to Hrazdan River		
Compliance with international stack emission standards ensures that critical levels will not be exceeded and will thus not represent any danger for flora and fauna		
Compliance with national and international noise emission standards ensures that critical levels will not be exceeded and will thus not represent any danger for fauna		
Strict prohibition of pesticide use for maintaining YCCPP-2 site (use mechanical methods only)		

Table 10-13: Summary of Mitigation Measures during Operation concerning Soil and Water Pollution

Mitigation measures to be applied during operation		
Issue for Mitigation: Soil and Water Pollution		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management, Thermal Power Plants)	**Responsible Party**	**Budget for implementing (USD)**
Oily waste water from Power plant operation will be duly collected and routed to a treatment plant before being discharged to recipient existing system. Treatment system will be suitably selected and implemented to meet the environmental limits and the good industry practice.	ArmPower	Included in operational costs
Rain water which may be potentially oily will be routed to the same system; other rain water collected from the paved areas will be disposed to the existing discharge system leading to Hrazdan River.		
HRSG blow down and other drainage from steam/water system will be neutralized at chemical shop to meet relevant water quality standards and will then be discharged to Hrazdan River using existing discharge system	ArmPower	Included in operational costs
The utility sewerage will be connected to YCCPP-1 sewerage system		
Train staff in appropriate sanitation practices		
Provide spill-control materials at YCCPP-2, in order to clean up spills, if necessary		
Enforcement of a Waste Management Plan		
Elaboration of an emergency plan in case of accidental leakage		
Remove contaminated soil if spills occur and handle as hazardous waste		
Prohibition of herbicides for maintenance of YCCPP-2		
Proper handling and storage of hazardous material (lockable, roofed, ventilated, concreted and bunded floor)		
Train staff in proper management of recyclable, sanitary, solid, liquid, and hazardous wastes		
Regular maintenance of all vehicles and machines at regular service stations, if possible		
Maintenance and re-fueling of the equipment only on sealed and enclosed areas		
If a lowering of the groundwater level at the construction/ plant site will be performed, an additional impact assessment including development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.		

Table 10-14: Summary of Mitigation Measures during Operation concerning Climate and Air Quality

Mitigation measures to be applied during operation		
Issue for Mitigation: Risks for Air Quality and Climate Change		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guidelines: Air Emissions and Ambient Air Quality, Thermal Power Plants)	**Responsible Party**	**Budget for implementing (USD)**
Maintain vehicles and engines properly, as recommended by suppliers	ArmPower	Included in operational costs
Avoid unnecessary idling of vehicles		
Compliance with performance guarantees for emission values		
Greenhouse gas emissions shall be quantified at least annually		

Table 10-15: Summary of Mitigation Measures during Operation concerning Landscape and Visual Aspects

Mitigation measures to be applied during operation		
Issue for Mitigation: Landscape and Visual Aspects		
Mitigation measures (considering General EHS)	**Responsible Party**	**Budget for implementing (USD)**
Visual impact due to buildings and stack of YCCPP-2 is unavoidable, if Project shall be implemented	ArmPower	Included in operational costs
Planting of indigenous trees and bushes along YCCPP-2 boundaries is recommended, in order to reduce the visual burden at least to some extent		

Table 10-16: Summary of Mitigation Measures during Operation concerning Waste Management.

Mitigation measures to be applied during operation		
Issue for Mitigation: Risks from Waste		
Mitigation measures (considering IFC PS 3, General EHS Guidelines and EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management, Thermal Power Plants)	**Responsible Party**	**Budget for implementing (USD)**
Collect all type of wastes including domestic and sanitary wastes during CCPP operation. Make arrangements for proper waste handling, treatment and disposal with municipal authorities about using services of communal service providers for waste disposal purposes.	ArmPower	Included in operational costs
Store all hazardous waste in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at YCCPP-2 site for future disposal		
Clearly label all hazardous waste and provide Materials Safety Data Sheets (MSDS)		
Train staff in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste		
Adequate storage and clear labeling and marking according to national / internationally recognized requirements and standards, including the International Chemical Safety Cards (ICSC), Materials Safety Data Sheets (MSDS), or equivalent, of all hazardous substances in chemical workshop (e.g. acids and alkaline solutions)		

Table 10-17: Summary of Mitigation Measures during Operation concerning Occupational Health & Safety

Mitigation measures to be applied during operation		
Issue for Mitigation: Risks for Workers' Health and Safety		
Mitigation measures (considering IFC PS 1, PS 2, General EHS-Guideline and EHS-Guidelines: Occupational Health and Safety, Thermal Power Plants)	**Responsible Party**	**Budget for implementing (USD)**
ArmPower will have a Health, Safety and Environment Management System (HSEMS) in place, according to their HSE Policy	ArmPower	Included in operational costs
Make sure that all staff has a health insurance		
Consider possible occurrence of poisonous snakes (train the workers on venomous species identification and bite handling, provide related first aid equipment).		
For workers noise levels shall be kept below 80 dB (A), wherever possible. Hand out ear protection devices to all workers, when necessary. According to WB/IFC General EHS Guideline, workers are obliged to wear ear protectors where 85 dB (A) are exceeded for duration of more than 8 hours.	ArmPower	Included in operational costs
Staff will be provided with appropriate protective equipment (PPE) according to RENCO's Occupational Health & Safety Standards		
Train staff accordingly regarding work at heights, electrical and vehicular safety, handling of hazardous materials, use of PPE, hazard avoidance and reduction measures, use of first aid and rescue techniques, emergency response, firefighting, etc.		
Forbid alcohol and other drugs at YCCPP-2 site		
Assure transfer of injured staff to hospitals in the case of serious accidents		
Limit occupational exposure to electric or magnetic fields (EMF) by use of shielding materials, signing of relevant areas and training of staff		
Maintain vehicles and machinery regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure		
Record work-hours as well as all accidents and incidents		
Implement and communicate an accessible grievance mechanism for staff to address any complaints		

Table 10-18: Summary of Mitigation Measures during Operation concerning Community Health & Safety

Mitigation measures to be applied during operation		
Issue for Mitigation: Risks for Public Health and Safety		
Mitigation measures (considering IFC PS 1, PS 4, General EHS-Guideline and EHS-Guidelines: Community Health and Safety, Thermal Power Plants)	**Responsible Party**	**Budget for implementing (USD)**
For residents the noise levels may not exceed 50 dB (A) during daytime and 45 dB (A) during night. According to WB/IFC General EHS Guideline, noise level for residents may not exceed 55 dB (A) or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site.	ArmPower	Included in operational costs
Compliance with performance guarantees for emission limits and compliance with design specifications to keep noise emissions low		
YCCPP-2 site will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access.		
Security arrangements to be guided by principles of proportionality, good international practice[26] and national law		
Security personnel shall be trained regarding the use of force and conduct towards the community		
Develop and implement an Emergency Preparedness and Response Plan (see Section 7.4.2)		
Provide appropriate information about Emergency Preparedness and Response Plan to potentially affected communities and individuals		
If a lowering of the groundwater level at the construction/ plant site will be performed, an additional impact assessment including development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.		

[26] e.g. UN Code of Conduct for Law Enforcement Officials, UN Basis Principles on the Use of Force and Firearms by Law Enforcement Officials

10.2 Monitoring Measures

The local HSE officer of ArmPower will monitor the implementation of mitigation measures by the EPC Contractor (RENCO SPA), based on regular inspections. An external internationally experienced auditor will prepare environmental and social performance reports for ADB/ IFC, based on quarterly site inspections and the monthly reports of ArmPower's HSE officer. ArmPower will be responsible for monitoring of environmental and social performance during operation of the CCPP.

10.2.1 Monitoring during the Construction Phase

Table 10-19: Summary of monitoring measures during Construction Phase

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Impacts on flora and fauna	Prohibition of herbicides for site clearance	Construction Site	Visual inspection	No herbicides used	At the beginning of construction period during site clearance	ArmPower
	Mitigation measures to be implemented to reduce risks of soil and water contamination do also mitigate the impact on flora and fauna			Measures for reduction of soil and water contamination implemented (see below)	Regularly during construction	ArmPower External auditor
	Mitigation measures to be implemented to noise reduction like using low sound power mechanical equipment do also mitigate the impact on noise sensitive fauna			Measures for noise reduction implemented (see below)		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Impacts on flora and fauna	Suppress dust generated by construction works by spraying water	Construction Site	Visual inspection	Dust effectively suppressed	Regularly during construction	ArmPower External auditor
Soil Erosion	Minimization of areas for construction and material storage	Construction Site	Visual inspection	Areas as small as possible	Regularly during construction	ArmPower External auditor
	Minimize removing topsoil at construction site and store in line with international good practice, so that it can be re-used after construction			Topsoil stored accordingly		
	Protect excess spoils, if any, from runoff			Excess spoils protected		
	Excess spoil / soil, to be left in orderly piles, covered with topsoil, and re-vegetated			Excess spoil / soil covered with topsoil and re-vegetated with native species		
Soil (and water) pollution from vehicles and construction equipment	Regular maintenance of vehicles/ machines at regular service stations, if possible	Construction Site	Inspection of maintenance records	Vehicles and machines adequately maintained	Regularly during construction	ArmPower External auditor
	Maintenance and re-fueling of construction equipment on sealed and enclosed areas		Visual inspection of maintenance/ re-fueling areas	No unsuitable areas used for maintenance and re-fueling		
Soil (and water) pollution from inadequate storage	Store all liquid materials (e.g. fuel, engine oil, paint, chemicals, lubricants) in locked tanks and on sealed, bunded and roofed areas	Construction Site Storage areas	Inspection of storage areas	All liquid materials stored accordingly	Regularly during construction	ArmPower External auditor

Activity/ Impact	What *parameter is to be monitored?*	Where *is the parameter to be monitored?*	How *is the parameter to be monitored/ type of monitoring equipment?*		When *is the parameter to be monitored-frequency of measurement or continuous?*	Responsibility
			Method	Indicator		
	Store construction material (bags of cement etc.) in containers in order to avoid rinsing out			Construction material stored accordingly		
Soil (and water) pollution from spills	In case of any spillage: Localization of the spilled material and immediate cleaning of the contaminated area in order to prevent the pollutant from entering soil	Construction Site	Inspection of spill reports	Area accordingly cleaned	Regularly during construction	ArmPower External auditor
	Train transporters and workers in spill prevention and control especially in handling of oil and fuel		Inspection of training records	All workers and transporters trained accordingly		
	Provide spill-control materials to drivers and workers, in order to clean up spills, if necessary		Inspection of equipment	Spill-control equipment provided		
Soil (and water) pollution from spills	Report and respond to spills promptly and train workers in how to report	Construction Site	Inspection of spill reports, and training records	Number of spill reports All workers trained accordingly	Regularly during construction	ArmPower External auditor
	Remove contaminated soil if spills occur and handle as hazardous waste	Storage areas	Inspection of spill reports and storage areas	All contaminated materials adequately stored		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Water pollution from sanitation	Construction site equipped with toilets and sanitary rooms according to IFC/ EBRD Guidance Note - separately for men and women	Construction Site	Visual inspection	Number and quality according to IFC/ EBRD Guidance Note[27]	Regularly during construction	ArmPower External auditor
	Lead sewage water to sewage water system of adjacent YCCPP-1 or use septic tanks for collecting sewage water, which have to be emptied by a specialized company from time to time.		Visual inspection Inspection of contract with specialized company (if necessary)	Sewage water led to system of YCCPP-1 or septic tanks in place. Appropriate emptying of tanks (if necessary)		
	Train workers in appropriate sanitation practices		Inspection of training records	All workers trained accordingly		
Water pollution from waste	Provide waste bins at the construction site in order to collect workers' waste (implement Waste Management Plan)	Construction Site	Visual inspection	Waste bin sin place and used by workers	Regularly during construction	ArmPower External auditor
Lowering of groundwater level	If a lowering of the groundwater level at the construction site will be performed, an additional impact assessment including development of mitigation measures will be required	Near construction sites	Interviews with third parties Inspection of complaints	Third parties informed and water supply secured; no complaints	In advance of construction	ArmPower External auditor

[27] see IFC/ EBRD Guidance Note on Workers' Accommodation (2009)

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Limitation of exhaust gas pollution	Reduction of speed and limited movement of vehicles	Construction Site	Inspection of complaints	No complaints from residents	Regularly during construction	ArmPower External auditor
	Optimize transportation management to avoid needless truck trips		Inspection of transportation management	No needless truck trips		
	Maintain vehicles and construction machinery properly, as recommended by suppliers		Inspection of maintenance records	Equipment regularly maintained		
	Avoid unnecessary idling of construction machines and vehicles		Visual inspection	No unnecessary idling		
Limitation of dust	Cover truck beds with tarps during material transport	Construction Site	Visual inspection	Truck beds covered	Regularly during construction	ArmPower External auditor
	Use dust-suppressing water spray during civil works, where necessary		Inspection of complaints	No complaints from residents		
Limitation of dust	Store and handle material appropriately to limit dust (e.g. protect cement with tarpaulins)	Construction Site	Visual inspection	Appropriate storage	Regularly during construction	ArmPower External auditor
Landscape and Visual Aspects	Use dust-suppressing water spray during civil works, where necessary	Construction Site	Inspection of complaints	No complaints from residents	Regularly during construction	ArmPower External auditor
Waste management	Develop Waste Management Plan for construction period	Construction Site Office of EPC	Control of Waste Management Plan	Waste Management Plan developed	In advance of construction	ArmPower

Activity/ Impact	What *parameter is to be monitored?*	Where *is the parameter to be monitored?*	How *is the parameter to be monitored/ type of monitoring equipment?*		When *is the parameter to be monitored-frequency of measurement or continuous?*	Responsibility
			Method	**Indicator**		
	Implementation of Waste Management System	Contractor	Control of Waste Management System	Waste Management System implemented		External auditor
	EPC Contractor will agree with municipal authorities about using services of communal service providers for waste disposal purposes.		Control of written agreement	Written agreement provided		
	Collect and segregate all type of wastes	Construction Site Storage areas	Visual inspection	All wastes collected and segregated	Regularly during construction	ArmPower External auditor
	Store all hazardous waste in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor)			All hazardous wastes adequately stored		
Waste management	Pack all hazardous wastes securely in sealed drums or other suitable containers, clearly identify them by labels, and provide Materials Safety Data Sheets (MSDS)	Construction Site Storage areas	Visual inspection	All hazardous wastes adequately packed and labeled and MSDS provided	Regularly during construction	ArmPower External auditor
	Existing waste material at the construction site has to be segregated and stored or disposed of accordingly	Construction Site	Visual inspection	All existing waste material segregated and stored or disposed of	In advance of construction	ArmPower
	Concrete waste can be disposed of at Yerevan dumping site or be used as land filling material			Concrete waste handled accordingly		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Training in waste handling	Train workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste	Construction Site	Inspection of training records	All workers trained accordingly	Regularly during construction	ArmPower External auditor
Impacts on Historical and Cultural Sites and Goods	Implementation of Chance Find Procedure and training of the construction workers	Construction Site	Inspection of chance find reports and training records	Chance Find Procedure implemented and all workers trained	Regularly during construction	ArmPower External auditor
	Report chance finds immediately to RA Ministry of Culture, Dep. Protection of Monuments and Historical Sites		Inspection of chance find reports	All chance finds reported to Ministry of Culture		
HSE Policy and HSE Management	EPC Contractor develops and implements site-specific Health, Safety and Environment Management Plan (HSEMP) for the construction phase	Office of EPC Contractor	Inspection of relevant documents	HSE Management Plan developed	In advance of construction works	ArmPower External auditor
	EPC Contractor develops and implements Health, Safety and Environment Management System (HSEMS) for construction phase. An H&S manager of EPC Contractor shall be on duty all the time during construction period.	Office of EPC Contractor Construction Site		HSE Management System implemented H&S Manager employed	Regularly during construction	

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
	HSEMP and HSEMS shall also be valid for any third parties or subcontractors in the supply chain			Subcontracts contain adequate HSEMP		
Occupational Health and Safety	Make sure that all workers have a health insurance	Construction Site	Inspection of workers' health documents	All workers have health insurance	Regularly during construction	ArmPower External auditor
	Awareness raising regarding sexually transmitted diseases (STD) should be provided to workforce		Inspection of training records	All workers trained accordingly		
	Consider possible occurrence of poisonous snakes during working		Inspection of incident and accident reports	No accidents related to poisonous snakes		
Occupational Health and Safety	For workers noise levels shall be kept below 80 dB (A), wherever possible. Hand out ear protection devices to all workers, when necessary.	Construction Site	Measurement with noise meter	Noise level below 80 dB (A); if noise levels are higher: workers fitted with PPE and warning signs installed	Regularly during construction	ArmPower External auditor
	Provide workers with appropriate protective equipment (PPE) according to RENCO's Occupational Health & Safety Standards		Visual Inspection	All workers provided with and using PPE		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
	Train workers accordingly regarding work at heights, electrical and vehicular safety, handling of hazardous materials, PPE, hazard avoidance and reduction measures, use of first aid and rescue techniques, emergency response, etc.		Inspection of training records	All workers trained accordingly		
	Identify area emergency responders, hospitals, and clinics, and provide advance notice of Project activities		Interviews	Area emergency responders informed about Project activities		
	Forbid alcohol and other drugs at construction site		Inspection of incident records	No workers found under influence of alcohol or other drugs		
Occupational Health and Safety	Assure transfer of injured workers to hospitals in the case of serious accidents	Construction Site	Inspection of accident records	Workers transferred to hospital in case of serious accidents	Regularly during construction	ArmPower External auditor
	Limit occupational exposure to electric or magnetic fields (EMF) by use of shielding materials, signing of relevant areas and training of workers		Interviews Inspection of training records	Shielding materials in place All workers trained accordingly		
	Licensing and training of drivers; improvement of driving skills		Inspection of licensing records	All drivers licensed and trained		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
	Training and licensing industrial vehicle operators in the safe operation of specialized vehicles, including safe loading/ unloading, and load limits		Inspection of training records	All vehicle operators trained and licensed		
	Maintain vehicles regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure		Inspection of maintenance records	Vehicles regularly maintained and approved parts used		
	Record work-hours as well as all accidents and incidents		Inspection of records	Recording implemented		
Occupational Health and Safety	Skilled working personnel (partly from abroad) will be accommodated in RENCO's guesthouse or at hotels in Yerevan. Local (mainly unskilled) workforce shall be employed from Yerevan and the adjacent villages. No workers' camps will have to be established as local workers will return to their home daily	Construction Site	Interviews	Accommodation for skilled personnel in adequate condition No workers' camps established	Regularly during construction	ArmPower External auditor

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
	Transfer of workers to and from the construction site shall be managed by the EPC Contractor (e.g. bus transfer)	Construction Site	Interviews	Transfer for workers established		
	Implement and communicate an accessible grievance mechanism for workers to address any complaints	Construction Site Office of EPC Contractor	Inspection of grievance log book Interviews	All grievances adequately treated		
Noise impacts on public and on workers	Use of machines with low sound power and fitting of construction machines with silencers or mufflers	Construction Site	Visual inspection and inspection of complaints	Low sound equipment used; no complaints from residents	Regularly during construction	ArmPower External auditor
	Regular maintenance and service of building machinery and vehicles during construction works		Inspection of maintenance records	Equipment regularly maintained		
Noise impacts on public and on workers	Shut down or throttling down of noisy machinery	Construction Site	Inspection of complaints	No complaints from residents	Regularly during construction	ArmPower External auditor
Noise impacts on public	Optimize transportation management to avoid needless truck drives	Construction Site	Inspection of complaints	No complaints from residents	Regularly during construction	ArmPower External auditor
	Allow truck movements only during daylight, but not between 7 pm and 6 am					

Activity/ Impact	What *parameter is to be monitored?*	Where *is the parameter to be monitored?*	How *is the parameter to be monitored/ type of monitoring equipment?*		When *is the parameter to be monitored-frequency of measurement or continuous?*	Responsibility
			Method	Indicator		
	Reduce vehicle speeds (stick to recommended speeds) in populated areas For residents the noise levels may not exceed 50 dB (A) during daytime and 45 dB (A) during night. IFC/WB General EHS Guideline: < 55 dB (A) or max. increase in background levels of 3 dB (A) at the nearest receptor location off-site.	Residential areas near construction site (up to 5 points)	Instrumental measurement	Noise level below 50 dB (A) during daytime and 45 dB (A) during night, or maximum increase of 3 dB (A)	5 hours of day-time measurements, twice per month during construction period (assumed no construction works at night)	RENCO/ ArmPower External auditor
Community Health and Safety	The construction site itself will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access to the site, thus also minimizing possible impacts on community health.	Construction Site	Inspection of incidents/ accidents records	No incidents/ accidents regarding public health and safety	Regularly during construction	ArmPower External auditor
	Security arrangements to be guided by principles of proportionality, good international practice[28] and national law	Construction Site Office of EPC Contractor	Inspection of security concept and contracts	Arrangements according to good international practice; No complaints from public		

[28] e.g. UN Code of Conduct for Law Enforcement Officials, UN Basis Principles on the Use of Force and Firearms by Law Enforcement Officials

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
	Security personnel shall be trained regarding the use of force and conduct towards the community		Inspection of training records	All security staff trained accordingly; No complaints from public		
Community Health and Safety	Provide adequate security measures to prevent accidents and injury (e.g. keeping speed limits)	Construction Site Office of EPC Contractor	Inspection of complaints and accident records	No complaints from residents; no accidents	Regularly during construction	ArmPower External auditor
	Inform population of small villages along public roads in advance, in case of transporting heavy equipment					
Community Health and Safety	Establish worker code of conduct to help prevent friction or conflict with communities	Construction Site Office of EPC Contractor	Inspection of complaints	Worker code of conduct established	Regularly during construction	ArmPower External auditor
	Develop and implement an Emergency Preparedness and Response Plan		Inspection of documents	Emergency Preparedness and Response Plan implemented		
	Provide appropriate information about Emergency Preparedness and Response Plan to potentially affected communities and individuals	Residents living near construction sites	Interviews with residents	Residents informed accordingly		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Employment	Implement non-discriminatory hiring and wage policy (clearly stating that the company will not discriminate in hiring and salaries based on gender, age, religion, ethnicity or place of origin), if not already in place	Construction Site Office of EPC Contractor	Inspection of employment contracts Inspection of complaints Interviews with employees	No complaints	Regularly during construction	ArmPower External auditor
	Prosecute offenses related to payment of wages by sub-contractors strictly					
	Prioritize employment of local people for construction works (offer job opportunities in nearby villages and Yerevan)			High percentage of local people employed		
Employment / Gender aspects	Improve recruitment of women for construction works	Construction Site Office of EPC Contractor	Inspection of employment contracts	25% of employees are female; thorough justification, if this rate cannot be kept	Regularly during construction	ArmPower External auditor
Gender aspects	Zero tolerance for sexual harassment at the work place	Construction Site	Inspection of complaints	No complaints from residents and from workers	Regularly during construction	ArmPower External auditor
Grievance Redress Mechanism	Implement and communicate an accessible grievance mechanism for PAP to address any complaints	Construction Site Office of EPC Contractor	Inspection of grievance log book Interviews with PAP	All grievances adequately treated	Regularly during construction	ArmPower External auditor

10.2.2 Monitoring during the Operation Phase

Table 10-20: Summary of monitoring measures during Operation Phase

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Impacts on flora and fauna	Oily waste water from power plant will be led to an oil-separator before entering the discharge system leading to Hrazdan River	YCCPP-2 site	Visual inspection Inspection of monitoring reports	Oil separator installed and working properly	Monthly monitoring	Environmental Monitoring and Information Center SNCO
	HRSG blow down and other drainage from steam/water system will be neutralized at chemical shop to meet relevant water quality standards and will then be discharged to Hrazdan River		Inspection of waste water monitoring reports	Drainage water does not exceed national limits for water quality		
	Compliance with international stack emission standards ensures that critical levels will not be exceeded and will thus not represent any danger for flora and fauna		Inspection of monitoring reports	Air emission does not exceed limits of international standards		
	Compliance with national and international noise emission standards ensures that critical levels will not be exceeded and will thus not be dangerous for sensitive fauna		Inspection of design data and noise measurements	Noise emissions do not exceed national or international limits (see below: noise impacts)	Regularly during operation	ArmPower

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Impacts on flora and fauna	Strict prohibition of herbicide use for maintaining YCCPP-2 site	YCCPP-2 site	Visual inspection	No herbicides used for maintaining	Regularly during operation	ArmPower
Soil and Water pollution	Oily waste water from Power plant operation will be duly collected and routed to a treatment plant before being discharged to recipient existing system. Treatment system will be suitably selected and implemented to meet the environmental limits and the good industry practice.	YCCPP-2 site	Visual inspection Inspection of monitoring reports	Treatment plant (oil separator) installed and working properly	Monthly monitoring	Environmental Monitoring and Information Center SNCO
	Rain water which may be potentially oily will be routed to the same system; other rain water collected from the paved areas will be disposed to the existing discharge system leading to Hrazdan River.		Visual inspection Inspection of monitoring reports	Treatment plant (oil separator) installed and working properly Drainage water does not exceed national limits for water quality		
	HRSG blow down and other drainage from steam/water system will be neutralized at chemical shop to meet relevant water quality standards and will then be discharged to Hrazdan River using existing discharge system		Visual inspection Inspection of waste water monitoring reports	Drainage water does not exceed national limits for water quality		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Soil and Water pollution	Utility sewerage will be connected to YCCPP-1 sewerage system	YCCPP-2 site	Inspection of monitoring reports	Sewage water led to system of YCCPP-1; not exceeding applicable limits for water quality	Monthly monitoring	Environmental Monitoring and Information Center SNCO
	Train staff in appropriate sanitation practices	YCCPP-2 site	Inspection of training records	All staff trained accordingly	Regularly during operation	ArmPower
	Provide spill-control materials at YCCPP-2, in order to clean up spills		Inspection of equipment	Spill-control equipment provided		
	Enforcement of a Waste Management Plan		Site inspection	All waste collected, segregated and stored/ disposed of appropriately		
	Elaboration of an emergency plan in case of accidental leakage		Inspection of emergency plan and of accident reports	Emergency Plan implemented and accidental leakages treated appropriately (if any)		
	Remove contaminated soil if spills occur and handle as hazardous waste	YCCPP-2 site Storage areas	Visual inspection	Contaminated soil handled as hazardous waste		
	Prohibition of herbicides for maintenance of YCCPP-2	YCCPP-2 site		No herbicides used for maintaining		
	Proper handling and storage of hazardous material (lockable, roofed, ventilated, concreted and bunded floor)	YCCPP-2 site Storage areas		Hazardous material properly handled and stored		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Soil and Water pollution	Train staff in proper management of recyclable, sanitary, solid, liquid, and hazardous wastes	YCCPP-2 site	Inspection of training records	All staff trained accordingly	Regularly during operation	ArmPower
	Regular maintenance of all vehicles and machines at regular service stations, if possible		Inspection of maintenance records	Vehicles and machines adequately maintained		
	Maintenance and re-fueling of the equipment only on sealed and enclosed areas		Visual inspection of maintenance and re-fueling areas	No unsuitable areas used for maintenance and re-fueling		
Permanent lowering of groundwater level	If a lowering of the groundwater level at the plant site will be performed, an additional impact assessment including development of mitigation measures will be required	Near the YCCPP-2 site	Interviews with third parties Inspection of complaints	Third parties informed and water supply secured; no complaints	Regularly during operation	ArmPower
Limitation of exhaust gas pollution	Maintain vehicles and engines properly, as recommended by suppliers	YCCPP-2 site	Inspection of maintenance records	Equipment properly maintained	Regularly during operation	ArmPower
	Avoid unnecessary idling of vehicles	YCCPP-2 site	Visual inspection	No unnecessary idling	Regularly during operation	ArmPower
Air emissions and air quality	Compliance with performance guarantees emission levels	Stack of YCCPP-2	Inspection of monitoring reports of CEMS data	Air emissions do not exceed ArmPower's Performance Guarantees (NOx: < 50; CO < 30; UHC < 10 mg/Nm³)	Continuously	ArmPower Environmental Monitoring and Information Center SNCO

Activity/ Impact	What *parameter is to be monitored?*	Where *is the parameter to be monitored?*	How *is the parameter to be monitored/ type of monitoring equipment?*		When *is the parameter to be monitored-frequency of measurement or continuous?*	Responsibility
			Method	**Indicator**		
	Greenhouse gas emissions shall be quantified annually	YCCPP-2 site	Inspection of monitoring reports of CEMS data	GHG emissions do not exceed IFC/ WB typical value of 396 g CO_2/kWh gross	At least annually during operation	ArmPower Environmental Monitoring and Information Center SNCO
	Monitoring of ambient air quality - NO_2	Residential areas near construction site (up to 5 points)	Instrumental measurement - e.g., diffusion tubes	Ground level concentrations of NO_2 do not exceed national and international standards	7 days of measurements, once per month during commissioning period	ArmPower Environmental Monitoring and Information Center SNCO
Waste Management	Collect all type of wastes during CCPP operation. Make arrangements for proper waste handling, treatment and disposal with municipal authorities about using services of communal service providers for waste disposal purposes	YCCPP-2 site	Visual inspection Inspection of agreement with waste collector	All waste collected, segregated and stored/ disposed of appropriately Domestic waste picked up regularly be waste collector	Regularly during operation	ArmPower
Waste Management	Store all hazardous waste in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at YCCPP-2 site for future disposal Clearly label all hazardous waste and provide Materials Safety Data Sheets (MSDS)	YCCPP-2 site Storage areas	Visual inspection Inspection of hazardous material/waste register	Hazardous waste and materials stored appropriately and clearly labelled; Materials Safety Data Sheets (MSDS) provided	Regularly during operation	ArmPower

Activity/ Impact	What *parameter is to be monitored?*	Where *is the parameter to be monitored?*	How *is the parameter to be monitored/ type of monitoring equipment?*		When *is the parameter to be monitored-frequency of measurement or continuous?*	Responsibility
			Method	Indicator		
	Adequate storage and clear labeling according to national / internationally recognized requirements and standards, including the International Chemical Safety Cards (ICSC), Materials Safety Data Sheets (MSDS), of all hazardous substances in chemical workshop (e.g. acids and alkaline solutions)					
Waste Management	Train staff in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste	YCCPP-2 site	Inspection of training records	All staff trained accordingly	Regularly during operation	ArmPower
HSE Policy and HSE Management	ArmPower will have a Health, Safety and Environment Management System (HSEMS) in place, according to their HSE Policy	YCCPP-2 site	Inspection of relevant documents	HSEMS in place	Regularly during operation	ArmPower
Employee Health and Safety	Make sure that all staff has a health insurance	YCCPP-2 site	Inspection of workers' health documents	All staff has health insurance	Regularly during operation	ArmPower
	Consider occurrence of poisonous snakes		Inspection of incident and accident reports	No accidents related to poisonous snakes		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
	For workers noise levels shall be kept below 80 dB (A), wherever possible. Hand out ear protection devices to all workers, when necessary		Visual Inspection	Noise level below 80 dB (A); if noise levels are higher: workers fitted with PPE and warning signs installed		
	Staff will be provided with appropriate protective equipment (PPE) according to RENCO's Occupational Health & Safety Standards		Visual Inspection	All staff provided with and using PPE		
Employee Health and Safety	Train staff accordingly regarding work at heights, electrical and vehicular safety, handling of hazardous materials, use of PPE, hazard avoidance and reduction measures, use of first aid and rescue techniques, emergency response, firefighting, etc.	YCCPP-2 site	Inspection of training records	All staff trained accordingly	Regularly during operation	ArmPower
	Forbid alcohol and other drugs at YCCPP-2 site		Inspection of incident records	No staff found under influence of alcohol or other drugs		
	Assure transfer of injured staff to hospitals in the case of serious accidents		Inspection of accident reports	Staff transferred to hospital in case of serious accidents		

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
	Limit occupational exposure to electric or magnetic fields (EMF) by use of shielding materials, signing of relevant areas and training of staff		Interviews Inspection of training records	Shielding materials in place All workers trained accordingly		
	Maintain vehicles and machinery regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure		Inspection of maintenance records	Vehicles regularly maintained and approved parts used		
	Record work-hours as well as all accidents and incidents		Inspection of records	Recording implemented		
Employee Health and Safety	Implement and communicate an accessible grievance mechanism for staff to address any complaints	YCCPP-2 site	Inspection of grievance log book Interviews	All grievances adequately treated	Regularly during operation	ArmPower
Noise impacts on public	For residents the noise levels may not exceed 50 dB (A) during daytime and 45 dB (A) during night. IFC/WB General EHS Guideline: < 55 dB (A) or max. increase in background levels of 3 dB (A) at the nearest receptor location off-site.	Residential areas near the YCCPP-2 site (up to 5 points)	Instrumental measurement	Noise level below 50 dB (A) during daytime and 45 dB (A) during night, or maximum increase of 3 dB (A)	5 hours of day-time and night-time measurements, twice per month during commissioning period	ArmPower Environmental Monitoring and Information Center SNCO

Activity/ Impact	**What** *parameter is to be monitored?*	**Where** *is the parameter to be monitored?*	**How** *is the parameter to be monitored/ type of monitoring equipment?*		**When** *is the parameter to be monitored-frequency of measurement or continuous?*	**Responsibility**
			Method	**Indicator**		
Public Health and Safety	Compliance with Performance Guarantees emission levels	YCCPP-2 site	Inspection of monitoring reports of CEMS data Inspection of complaints	Air emissions do not exceed limits of ArmPower's Performance Guarantees No complaints	Regularly during operation	ArmPower
	YCCPP-2 site will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access.		Inspection of incidents/ accidents records	No incidents/ accidents regarding public health and safety		
Public Health and Safety	Security arrangements to be guided by principles of proportionality, good international practice and national law	Construction Site Office of Operator at YCCPP-2	Inspection of security concept and contracts	Arrangements according to good international practice; No complaints from public	Regularly during operation	ArmPower
	Security personnel shall be trained regarding the use of force and conduct towards the community		Inspection of training records	All security staff trained accordingly; No complaints from public		
	Develop and implement Emergency Preparedness and Response Plan	Office of Operator at YCCPP-2	Inspection of documents	Emergency Preparedness and Response Plan implemented		
	Provide appropriate information about Emergency Preparedness and Response Plan to potentially affected communities and individuals	Near the YCCPP-2 site	Interviews with residents	Residents informed accordingly		

10.3 Implementation Arrangements and Capacity Building

The new power plant YCCPP-2 will be constructed by RENCO SPA and operated by ArmPower CJSC, which is a subsidiary company of RENCO SPA.

RENCO SPA has a Health, Safety and Environment Policy (2015) in place, in order to meet the requirements, regulations and communities affairs for the health of all persons working under the control of RENCO, environment protection and plants safety. An integrated system for safety, environment and quality has been implemented in compliance to international guidelines and standards (like OHSAS 18001 and ISO 14001 standards). Among others RENCO SPA has also a Social and Cultural Heritage Policy (2016) as well as an Anti-Corruption Policy (2016) and a Code of Ethics in place.

The above mentioned policies and HSE management systems shall also be established at ArmPower CJSC as subsidiary company of RENCO SPA.

RENCO SPA as EPC Contractor has to implement the ESMP within its own site-specific Health, Safety and Environment Management System (HSEMS) in a proper way and shall have an HSE manager on duty throughout the construction period. This HSE officer shall prepare monthly reports of all HSE relevant incidents and accidents and send these reports to the Health, Safety and Environment Manager of ArmPower and the relevant national authorities (like the Ministry of Nature Protection, Ministry of Health) as well as to the external internationally experienced auditor.

An external internationally experienced auditor shall perform quarterly supervision of the implementation of the ESMP and monitor the implementation of the mitigation measures. The aim of the audits will be to ensure that all mitigation measures are implemented adequately. In case of any discrepancies, the specialist shall implement proper actions to establish compliance with the ESMP. If this is not possible and if the discrepancy is considered to be severe, the person(s) in charge shall be empowered to stop the work immediately until compliance is achieved again. Based on his quarterly supervision and the monthly reports provided by the Health, Safety and Environment Manager of RENCO, the external auditor will produce narrative analytical quarterly reports on environmental and social performance in the course of the Project and furnish these reports to ADB/ IFC and to ArmPower.

The monitoring of noise levels during construction and commissioning phases, of air emissions during commissioning and operation (during operation based on CEMS at the stack) as well as of liquid effluents during operation of YCCPP-2 shall be done by “Environmental Monitoring and Information Center SNCO” of the Ministry of Nature Protection of the RA.

However, during the site visit in July 2017 FICHTNER’s environmental specialist was informed that **there are not enough capacities** at the named

institution for implementing these monitoring programs. Thus, measures for capacity building shall be considered. These measures should include employment of additional staff or contracting outside resources for monitoring purposes (or both). Existing staff shall be trained in effective monitoring procedures including knowledge about national and international (ADB, IFC/World Bank) guidelines and limit values.

10.4 Summary of Costs for Implementation of the EMSP

All costs for mitigation of the impacts during the construction and operation periods of the Project are included in the regular construction / operational costs. Construction works are foreseen to run for a duration of 2.5 years.

In case the monitoring of ambient air and ambient noise at the power plant's surrounding is not overtaken by the Environmental Monitoring and Information Center SNCO, the costs are calculated as 71,500 USD (Table 10-21).

Parameter	Stage	Frequency and duration	Location	Total cost
Ambient Noise	Construction	Twice per month, 5 hours each time, for 30 months	Up to 5 points in residential areas	50,000 USD
	Commissioning	Twice per month, 5 hours each time, for 12 months	Up to 5 points in residential areas	20,000 USD
Ambient air quality - NO_2	Commissioning	Once per month, 7 days each time, for 12 months	Up to 5 points in residential areas	1,500 USD
TOTAL				**71,500 USD**

Table 10-21: Monitoring costs for ambient air and noise

Additional costs are foreseen for quarterly supervision of construction sites to be performed by an internationally experienced auditor. One supervision mission is estimated to cost approx. 10,000 USD, including flights and reporting. Thus, the supervision will sum up to 100,000 USD for 2.5 years.

A total cost of **171,500 USD** is foreseen.

10.5 Gap Analysis regarding compliance with IFC Performance Standards

The compliance of the Project with the main requirements of the IFC Performance Standards after implementation of the mitigation and monitoring measures given in the ESMPs is analyzed in Table 10-22 below.

Table 10-22: Compliance of the Project with main requirements of IFC Performance Standards (PS)

Main requirements of Performance Standards	Assessment
PS 1: Assessment and Management of Environmental and Social Risks and Impacts	
PS 1: Policy	
Has a formal policy defining the environmental and social objectives and principles that guide the project been established?	Yes; RENCO has Health, Safety and Environment Policy in place and will develop a site specific Health, Safety and Environment Management System (HSEMS) for the Project; this shall also be established at ArmPower which is a subsidiary company of RENCO SPA
Is the policy consistent with the principles of the PS or other internationally recognized standards?	Yes; the certified Policy complies to OHSAS 18001 and ISO 14001 standards
PS 1: Identification of risks and impacts	
Is there a process to assess the environmental and social impacts and risks of the project?	Yes; A National Environmental Impact Assessment has been prepared in 2016; Fichtner currently prepares the ESIA study (including ESMP) assessing environmental and social impacts
Have recent environmental and social baseline data at an appropriate level of detail been used in the assessment?	Yes; Site visit by Fichtner's environmental and social experts in 2017 including stakeholder interviews; recent reports on geological situation and national EIA study as baseline; reports on groundwater quality and soil contamination at the site have just been prepared; measurements of background air quality and noise levels by Fichtner for Air Dispersion Calculation and Noise Propagation Study as part of the ESIA
Have all relevant risks and impacts been assessed, including the issues identified in PS 2 to 8?	Yes; all relevant impacts assessed in Fichtner's ESIA study. PS 5 and PS 7 are not applicable to the Project
Are the risks and impacts related to the emission of GHG and climate change considered, as well as adaptation opportunities?	Yes; see Section 7.2.5 of Fichtner's ESIA study
Have transboundary effects been considered?	Not applicable
Have the impacts been identified in the context of the project's area of influence?	Yes; assessed Project Area includes residential areas and illegal housings in the vicinity of the planned power plant

Main requirements of Performance Standards	Assessment
Have cumulative impacts been assessed?	Yes; Air Dispersion Calculation and Noise Propagation Study as part of Fichtner's ESIA study consider also the existing background levels
Have risks and impacts related to the actions of third parties been assessed?	Yes; if any third parties will be engaged they will have to comply to RENCO's HSE Policy and site-specific HSEMS
Has the assessment considered the findings of plans, studies and assessments prepared by relevant government authorities and other parties directly related to the project?	Yes; National project approval from Ministry of Nature Protection has been given in 2017 based on the national EIA and geological reports; National reports have been used as baseline for Fichtner's ESIA study
Have disadvantaged or vulnerable groups been identified?	Yes; Some illegal residents are located in the vicinity of the planned construction site
If so, do any adverse impacts fall disproportionately on them?	No
PS 1: Management Programs	
Has a program of mitigation and performance improvement measures that addresses identified impacts and risks been developed?	Yes; Environmental and Social Management Plans for construction and operation phases of the Project are part of Fichtner's ESIA study. Mitigation Measures of the ESMPs will have to implemented by the EPC Contractor (RENCO SPA)
Does the program take into account the engagement process with affected communities?	Yes; Engagement process with affected communities is foreseen; Stakeholder Engagement Plan is part of Fichtner's ESIA study
Does the program include estimates of the resources for implementation?	Yes; Implementation of all mitigation measures during construction and operation phases are part of construction/ operational budgets
Does the program include definition of the responsibilities for implementation?	Yes; Implementation arrangements are defined in Section 10.3 of Fichtner's ESIA study
PS 1: Organizational Capacity and Competency	
Are responsibilities and authorities for implementation of the management program defined and communicated appropriately through the client's organization?	Yes; National project approval has already been given by Ministry of Nature Protection; other authorities (e.g. for waste management, monitoring of air and noise emissions as well as effluents, possible chance finds of cultural goods) are named in Fichtner's ESIA and will be contacted by the client.

Main requirements of Performance Standards	Assessment
Do the persons with responsibility for implementing the management program have the necessary knowledge, skills and experience?	Yes; RENCO has a certified Health, Safety and Environment Policy in place and will establish a HSE Manager for the Project; the same will be done at ArmPower as subsidiary of RENCO
PS 1: Emergency Preparedness and Response	
Are there emergency preparedness and response plans that are commensurate with the level of project risks?	Yes; Emergency preparedness and response plans will have to be developed by EPC Contractor for construction and Operator for operational phase; these plans are part of the mitigation measures given in Fichtner's ESIA study
In the event emergency preparedness and response requires participation of the community and the local governmental agencies, have they been involved?	Yes; Communities and local government authorities will be involved in those plans
PS 1: Monitoring and Review	
Have procedures to monitor and measure on a regular basis the effectiveness of the management program established, including the use of external experts and/or affected communities where appropriate?	Yes; Monitoring the implementation of mitigation measures is part of Fichtner's ESIA study; Monitoring will be done by RENCO's and ArmPower's HSE Managers and an internationally experienced auditor
Is the management program regularly updated based on the results of the monitoring?	Yes; Monitoring reports will update the ESMP regularly, if necessary
Is appropriate environmental and social performance information periodically reported internally to senior management?	Yes; ArmPower's HSE Manager will report the monitoring results to senior management of ArmPower and to internationally experienced auditor
PS1: Stakeholder Engagement	
Has the range of stakeholders for the project been identified?	Yes; see Stakeholder Engagement Plan (including Grievance Redress Mechanism) which is part of Fichtner's ESIA study
Has a Stakeholder Engagement Plan been established?	
Are differentiated measures deemed to allow the participation of those identified as disadvantaged or vulnerable included?	
Has appropriate disclosure of relevant project information to, and consultation with, affected communities been conducted?	Yes; affected communities have been informed and possible concerns collected during site visit of Fichtner's environmental and social experts in 2017; Draft ESIA and ESMP will be disclosed to public and Public Consultation meeting will be performed to finalize ESIA study

Main requirements of Performance Standards	Assessment
Has the disclosure and consultation process been: • Timely (early in the process)? • Culturally appropriate (language, gender issues)? • Free of external manipulation, interference, coercion or intimidation? • Transparent? • Meaningful? • Documented?	Yes; see Stakeholder Engagement Plan (including Grievance Redress Mechanism) which is part of Fichtner's ESIA study
For projects with potentially significant adverse impacts on Affected Communities, has a process of Informed Consultation and Participation been undertaken?	
Are Indigenous Peoples engaged in a process of ICP (Informed Consultation and Participation)?	Not applicable
Was the Indigenous Peoples FPIC (Free, Prior and Informed Consent) obtained?	
PS 1: External Communications and Grievance Mechanisms	
Is there a procedure for receiving external communications, screening and assessing the issues raised and providing answers and adjustments to the management plan?	Yes; Grievance Mechanism is part of Fichtner's ESIA study and of the Stakeholder Engagement Plan; Public Consultation Meeting will be performed to finalize ESIA study
Are reports on the environmental and social sustainability of the project publicly available?	Yes; ESIA study and ESMP will be disclosed before Public Consultation meeting
Has an effective grievance mechanism for affected communities been established?	Yes; Grievance Mechanism is part of Fichtner's ESIA study and of the Stakeholder Engagement Plan
PS 1: Ongoing reporting for affected communities	
Are (at least) annually reports provided to the affected communities describing the progress with the implementation of the Action Plans on issues involving risks to them and on those issues identified through the consultation/grievance mechanisms?	Yes; see Stakeholder Engagement Plan (including Grievance Redress Mechanism) which is part of Fichtner's ESIA study
PS 2: Labor and Working Conditions	
PS 2: Human Resource Policies and Procedures	
Are appropriate human resources policies and procedures available that address all requirements of PS 2 and national law?	Yes; RENCO has a certified Health, Safety and Environment Policy (2015), a Social and Cultural Heritage Policy (2016), an Anti-Corruption Policy (2016), and a Code of Ethics in place, which shall all also be established at ArmPower as subsidiary company of RENCO
Are the workers provided with information regarding their rights?	

Main requirements of Performance Standards	Assessment
PS 2: Working conditions and terms of employment	
Are any established collective bargaining agreement with workers' organizations respected?	Yes; RENCO has a certified Health, Safety and Environment Policy (2015), a Social and Cultural Heritage Policy (2016), an Anti-Corruption Policy (2016), and a Code of Ethics in place, which shall all also be established at ArmPower as subsidiary company of RENCO.
Is it ensured that the migrant workers are engaged on substantially equivalent terms and conditions to the non-migrant workers carrying similar work?	
Where accommodation services are provided, is it ensured that: • Policies on the quality and management of the accommodations and basic services are implemented? • Principles of non-discrimination and equal opportunity guide the accommodation services? • The accommodation's arrangements do not restrict worker's freedom of movement or association?	Yes; Skilled workers (partly from abroad) will be accommodated in RENCO's guesthouse or in hotels in Yerevan; Unskilled workers will be employed in adjacent villages and Yerevan, thus no workers' camps are necessary, as workers can get back to their homes after work
PS 2: Workers' Organizations	
Is there a compliance with the national law in allowing workers to form and join workers organizations?	PS 2 is based on a number of international conventions and instruments, including those of the International Labor Organization (ILO) and the United Nations (UN). All of them are ratified by the Republic of Armenia, except "UN - International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families" which has only been signed and ratification is still pending. For RENCO's and ArmPower's policies see above.
If national law substantially restricts workers organizations, have there been restrictions imposed to workers to express their grievances and protect their rights organizations?	
PS 2: Non-discrimination and Equal Opportunity	
Is it ensured that employment decisions are not made on the basis of personal characteristics unrelated to job requirements?	Yes; For RENCO's and ArmPower's policies see above. These issues are also part of the ESMPs in Fichtner's ESIA study.
Is harassment, intimidation and/or exploitation of workers, especially women and migrant workers, avoided?	
PS2: Retrenchment	
If any collective dismissal was applied, has an analysis of alternatives to retrenchment been made?	Not applicable
If retrenchment of a significant number of employees is expected, has a plan been developed to implement the retrenchment in compliance with all legal and contractual requirements?	

Main requirements of Performance Standards	Assessment
PS 2: Grievance Mechanism for workers	
Is a grievance mechanism for workers provided to raise workplace concerns that: • is easily accessible; • is understandable? • is transparent? • allows anonymous complains?	Yes; RENCO and ArmPower will establish adequate grievance mechanisms for workers as has been done in many other international projects; this issue is also part of the ESMPs of Fichtner's ESIA study.
PS 2: Child Labor	
Does the project employ children?	No; for RENCO's and ArmPower's policies see above
Where national laws allow the employment of minors: • are the provisions of those laws followed by the client? • are minors kept away from hazardous work? • are minors subject to appropriate risk assessment and regular monitoring of health, working conditions and hours of work?	Not applicable; national law does not allow child labor
PS 2: Forced Labor	
Does the project employ forced labor or trafficked persons?	No; for RENCO's and Armpower's policies see above
PS 2: Occupational Health & Safety (OHS)	
Does the project provide the workers with a safe and healthy work environment?	Yes; RENCO as EPC Contractor will establish site-specific HSE Management System according to its certified HSE Policy and employ an HSE Manager for the project. ArmPower shall do the same for operation. Emergency preparedness and response plans will be developed for the Project. These topics are also part of the ESMPs in Fichtner's ESIA study
Have steps been taken to prevent accidents, injury, and disease?	
Have the workers been trained in occupational health and safety?	
Are occupational accidents, diseases, and incidents documented and reported?	
Is there an emergency prevention, preparedness and response arrangement for the project?	
PS 2: Workers Engaged by Third Parties	
Are there policies and procedures for managing and monitoring the performance of third party employers in relation to the requirements of this PS?	Yes; if any third parties will be engaged they will have to comply to RENCO's HSE Policy and site-specific HSEMS, including grievance mechanism
Is the access of the workers engaged by third parties to a grievance mechanism guaranteed?	
PS 2: Supply Chain	
If there is a high risk of child or forced labor in the primary supply chain, are these risks identified and monitored, and are the necessary steps taken to remedy them?	Yes; supply chain has to comply to RENCO's HSE Policy and site-specific HSEMS

Main requirements of Performance Standards	Assessment
If there is a high risk of significant safety issues related to supply chain workers, is it ensured that the primary suppliers are preventing these situations?	Yes; supply chain has to comply to RENCO's HSE Policy and site-specific HSEMS
In case of need, does the project shift its primary supply chain to suppliers that can demonstrate the compliance with this PS?	
PS 3: Resource Efficiency and Pollution Prevention	
PS 3: Resource Efficiency	
Have the project's operations incorporated resource conservation and energy efficiency measures?	Yes; Power plant will use highly efficient state-of the-art equipment and will work as closed cycle system
Where GHG emissions (direct plus indirect from purchased electricity) exceed 25,000 tons CO_2 annually is annual quantification undertaken?	Yes; annual quantification of GHG emissions is part of the operational ESMP in Fichtner's ESIA study
In case the project is a potentially significant consumer of water, have measures to avoid or reduce the water usage been adopted?	Power Plant will work as closed cycle system
PS 3: Pollution Prevention	
Is the release of pollutants avoided/ minimized?	Yes; release of pollutants will be minimized, e.g. by using highly efficient technology like low-NOx burner, cleaning/ neutralizing waste water; air emissions and effluents will be monitored in order to fulfill relevant national and IFC/WB standards
Have the following factors been included in the assessment of potential adverse project impacts: existing ambient conditions; the finite assimilative capacity of the environment; existing and future land use; the project's proximity to areas of importance to biodiversity; and the potential for cumulative impacts?	Yes; most factors included in Fichtner ESIA study; ambient air pollution and noise level are measured as background data; land use, influence on biodiversity and potential for cumulative impacts have been assessed
Is the following hierarchy for waste management followed: avoidance, reduction, recovery, re-usage, treatment, destruction and final environmentally sound disposal?	Yes; EPC Contractor will have to implement Waste Management Plan as part of his HSE Management Plan; these issues are also part of the ESMPs in Fichtner's ESIA study
Are special provisions for hazardous waste disposal considered?	Yes; Hazardous waste will have to be stored in closed, roofed, ventilated, concreted and bunded storage areas for final disposal according to mitigation measures of ESMPs in Fichtner's ESIA study

Main requirements of Performance Standards	Assessment
Is the release of hazardous materials avoided/minimized/controlled?	Yes; oily waste water will be led to an oil separator before entering discharge system of YCCPP-1; HRSG blow down and other drainage from steam/water system will be neutralized at the chemical shop of the power plant before discharging
Are hazardous materials which are subject to international bans or phase-outs used?	No
If pesticides are used, is their selection and management consistent with good international industry practice and part of an integrated pest management and/or vector management strategy?	Not applicable, as no pesticides will be used for clearing of construction site or for maintenance during operation, according to the ESMPs in Fichtner's ESIA study
PS 4: Community Health, Safety, and Security	
PS 4: Community Health and Safety	
Has the potential for community risks and impacts associated with the project been evaluated?	Yes; risks and impacts are assessed in Fichtner's ESIA study and mitigation measured presented in the ESMPs
Have preventive and control measures consistent with GIIP been established?	
PS 4: Infrastructure and Equipment Design and Safety	
Have the structural elements of the project been designed, constructed, operated and decommissioned in accordance with GIIP?	Yes; new YCCPP-2 will be constructed as state-of-the-art power plant
PS 4: Hazardous Materials Management and Safety	
Is the potential for community exposure to hazardous materials and substances that may be released by the project avoided or minimized?	Yes; hazardous waste will be stored accordingly on-site; waste water will be cleaned and neutralized; construction site and power plant will be fenced and guarded by security personnel to avoid unauthorized entry; these topics are part of the ESMPs in Fichtner's ESIA study
PS 4: Ecosystem Services	
Have impacts and risks on priority ecosystem services in use by the Affected Communities been identified?	Not applicable
PS 4: Community Exposure to Disease	
Does the project avoid or minimize the potential for community exposure to water-related and vector-borne diseases caused by the project, including influx of labor?	Not applicable
PS 4: Emergency Preparedness and Response	
See PS 1	

Main requirements of Performance Standards	Assessment
PS 4: Security Personnel	
Have security arrangements guided by principles of proportionality, good international practice, and the national law been made?	Yes; Construction site and power plant will be fenced and guarded by security personnel; PS 4 requirements are part of the ESMPs of Fichtner's ESIA study and thus, will have to be implemented by EPC Contractor and Operator; Grievance Mechanism will be implemented
Is it assured that the security personnel has not been implied in past abuses?	
Have the security personnel been provided training in the use of force and conduct towards the community?	
Has the community been provided with a grievance mechanism through which complains regarding the security arrangements can be done?	
PS 5: Land Acquisition and Involuntary Resettlement	
PS 5 is not triggered by the Project: all land for construction/ operation of YCCPP-2 already acquired. No physical relocation. Existing access roads will be used.	
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	
PS 6: General	
Has the significance of project impacts on biodiversity and ecosystem services been specifically addressed as part of the social and environmental assessment process?	Yes; see Sections 7.1.1 and 7.2.1 and mitigation measures in the ESMPs of Fichtner's ESIA study
Has the practice of adaptive management been adopted?	Not applicable
PS 6: Protection and Conservation of Biodiversity	
Has a hierarchy of avoidance, minimization, restoration and compensation (biodiversity offsets) been considered?	Not applicable
Have natural habitat areas been conversed or degraded? If yes, have the conditions of PS 6 been respected?	No
Have natural habitat areas suffered a net loss of biodiversity?	
Has the implementation of project activities been undertaken in critical habitat? If yes, have the conditions of PS 6 been respected?	
If critical habitat is affected, has a Biodiversity Action Plan been designed to achieve net gains of biodiversity?	Not applicable
Has the implementation of project activities been undertaken in a protected or internationally recognized area? If yes, have the conditions of PS 6 been respected?	No

Main requirements of Performance Standards	Assessment
Do the project activities imply the introduction of alien species and/or of alien species with a high risk of invasive behavior?	No
If applicable, has the intentional introduction of alien species been carried out according to specific regulatory framework?	Not applicable
Have measures been designed to avoid unintentional introduction or spreading of alien species?	
PS 7: Indigenous Peoples	
PS 7 is not triggered by the Project as no groups of Indigenous People are living in the Project Area.	
PS 8: Cultural Heritage	
PS 8: Protection of Cultural Heritage in Project Design and Execution	
Has cultural heritage been considered as part of the environmental and social assessment?	Yes; see Section 7.3.3 of Fichtner's ESIA study
If the project is located in an area where cultural heritage is expected to be found, has a Chance Find Procedure been established?	No cultural heritage is expected to be found during construction. However, a Chance Find Procedure will be implemented, according to ESMP of Fichtner's ESIA study
Have the Affected Communities who use or have used the cultural heritage for long-standing cultural purposes been consulted?	Not applicable
Is continued access allowed to the cultural site or is an alternative route provided, in case of affectation of sites used for long-standing cultural purposes?	
Has a hierarchy of avoidance, minimization, restoration in situ and restoration off site, and compensation been undertaken?	
If non-replicable cultural heritage needs to be removed, have the following conditions of PS 8 been satisfied?: no technically or financially feasible alternatives existed; the benefits of the projects outweighed the anticipated cultural heritage loss from removal; and removal was conducted by the best available technique.	
If critical heritage is removed, significantly altered, or damaged by the project, have a process of ICP been undertaken with the Affected Communities?	
If the project is located in a legally protected area or a legally defined buffer zone, have the following conditions of PS 8 been satisfied?: compliance with defined regulations and the protected area management plans; consultation with the protected area sponsors and managers, local communities and other key stakeholders? Implementation of additional programs as appropriate to promote and enhance the conservation aims of the protected area.	

Main requirements of Performance Standards	Assessment
PS 8: Project's use of cultural heritage	
If the project will use cultural resources, knowledge, innovations, or practices of local communities embodying traditional lifestyles for commercial purposes, has the client entered a process of ICP?	Not applicable
Have fair and equitable sharing of benefits been ensured?	

10.6 Environmental and Social Action Plan

An Environmental and Social Action Plan is presented in this section in order to highlight the most urgent steps for implementation of the mitigation measures given in the ESMPs, naming also the relevant IFC Performance Standards and/or international guidelines and standards.

Table 10-23: Environmental and Social Action Plan including the main mitigation topics

Action	Requirement (IFC Performance Standard, Best Practice)	Responsibility	Implementation Schedule (Timeline)	Target for successful implementation / Reporting requirement
Public Consultations	IFC PS 1	ArmPower with support from FICHTNER as ESIA Consultant	After disclosure of Draft ESIA study and ESMP; In advance of construction	All Project Affected People and relevant stakeholders involved in Public Consultations (PC); Concerns and comments from PC included in final version of Fichtner's ESIA study
Implementation of Grievance Redress Mechanism for Project Affected People	IFC PS 1	RENCO as EPC Contractor ArmPower as Operator	In advance of construction; to be valid during construction and operation	Grievance log book and reports on successful handling the grievances
Preparation of additional impact assessment regarding water supply and development of mitigation measures, due to the possible lowering of groundwater level during construction or permanently	IFC PS 4 IFC/ WB General EHS-Guidelines	RENCO as EPC Contractor ArmPower as Operator	In advance of construction	Impact assessment and Management Plan including measures such as informing third parties and provision of water supply alternatives, if necessary
Emergency Preparedness and Response Plans and Security issues	IFC PS 1, 4	RENCO as EPC Contractor ArmPower as Operator	In advance of construction	Emergency Preparedness and Response Plans for construction and operation

Action	Requirement (IFC Performance Standard, Best Practice)	Responsibility	Implementation Schedule (Timeline)	Target for successful implementation / Reporting requirement
Development of a site-specific Health, Safety and Environment Management Plan (HSEMP), Health, Safety and Environment System (HSEMS) including grievance mechanism for workers, and establishment of HSE officer	IFC PS 2, 3 IFC/ WB General EHS-Guidelines IFC/ WB EHS Guidelines for Thermal Power Plants IFC/ WB EHS Guidelines for Electric Power Transmission and Distribution	RENCO as EPC Contractor ArmPower as Operator	In advance of construction, valid during construction and operation phase	Site-specific HSEMP and HSEMS for construction and operation periods; Grievance log book and reports on successful handling the grievances; HSE officers established at RENCO and ArmPower
Development of Waste Management Plan and Waste Management System for construction and operation phase	IFC PS 3 EU Directive 2008/98/EC (Waste Framework Directive)	RENCO as EPC Contractor ArmPower as Operator	In advance of construction	Waste Management Plans according to EU Directive 2008/98/EC
Provision of toilets and sanitary rooms for the workforce at the construction site, separately for men and women, as part of the HSEMP. Sewage water to be led to the sewage water system of YCCPP-1 or installation of septic tanks for collecting sewage water, which then would have to be emptied by a specialized company from time to time.	IFC PS 2, 3 IFC/ EBRD Guidance Note on Workers' Accommodation (2009)	RENCO as EPC Contractor	In advance of construction and during construction phase	Provision of adequate toilets and sanitary facilities and appropriate handling of sewage water Contract with specialized disposal company (if necessary)
Development of Chance Find Procedure regarding historic and cultural goods	IFC PS 8	RENCO as EPC Contractor	In advance of construction to be valid during construction	Chance Find Procedure established as well as training program for workforce

Action	Requirement (IFC Performance Standard, Best Practice)	Responsibility	Implementation Schedule (Timeline)	Target for successful implementation / Reporting requirement
Development of site-specific non-discriminatory hiring and wage policy; Employment of local people for construction works (offer job opportunities in nearby villages and Yerevan); Improve recruitment of women for construction works	IFC PS 2 Guidelines of International Labor Organization (ILO)	RENCO as EPC Contractor ArmPower as Operator	In advance of construction	Work contracts according to guidelines of International Labor Organization (ILO)
Air quality monitoring campaign to be repeated in next autumn, winter and spring in order to cover all seasons of an annual cycle	IFC PS 3, 4	RENCO as EPC Contractor	In advance of construction	Updated Air Dispersion Calculation (ADC)

11. Overall Findings, Conclusion, and Recommendations

The main possible impacts of the Project will be contamination of soil and water, impacts on health and safety of workers and the public, possible lowering of the groundwater level (still to be investigated) at the construction/power plant site, air and noise emissions and liquid effluents from the new power plant.

Negative environmental and social impacts of the Project will be low or medium, if all proposed mitigation measures of the ESMP are implemented. There will be no severe social impacts from the Project; no land acquisition nor resettlement will be necessary. Regular **monitoring of noise and air emissions as well as effluents** during construction and /or operation phase shall be performed, in order to guarantee adherence to relevant national and/or international limit values.

Positive impacts are related to creating job opportunities, especially during construction. The additional power generation will increase the total output of electric energy, providing a more reliable power supply countrywide.

If a lowering of the groundwater level at the construction/ plant site will be performed, an additional impact assessment including development of mitigation measures will be required, such as communications to third parties, providing water supply alternatives in case of need, etc.

In summary, it can be concluded that the proposed Project of Yerevan Steam and Gas Combined Cycle Power Plant (YCCPP-2) **can be implemented without having significant adverse impacts on the ecological and social environment**, if all mitigation measures proposed in the ESMPs are implemented.

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