Non-Technical Summary

Modernization of Almaty CHP 2, Kazakhstan

June 2022

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Acronyms and Abbreviations

Name	Description
BAT	Bets Available Techniques
CHP	Combined heat and power plant
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
GP	Gardeners' partnership
GRM	Grievance Redress Mechanism
H&S	Health and Safety
ILO	International Labor Organisation
JSC	Joint-stock company
JSC "AIES"	Joint-Stock Company "Almaty Electric Stations"
PR	Rerformance Requirements
SEP	Stakeholder Engagement Plan
SPZ	Sanitary Protection Zone

1. INTRODUCTION

The European Bank for Reconstruction and Development (“EBRD” or the “Bank”) and Samruk Energy of Kazakhstan are considering the modernisation and reconstruction of CHP-2 of Almaty (the “Project”), one of the three CHPs that provide heat to the district heating network of the city operated by Almaty Electric Stations JSC ("JSC AlES" or the “Company”). JSC “AlES” is the company that owns and operates the main heat supply infrastructure for the city of Almaty consisting mainly of the CHP-1, CHP-2, CHP-3 and the Heat Only Boilers.

The main purpose of the Project is the full replacement of coal by natural gas as the primary fuel.

This document is a Non-Technical Summary (NTS) of the Gap Analysis study for the CHP-2 modernization Project. The purpose of the NTS is to provide the public with simple and accessible basic information on the Project and its impacts.

2. PROJECT OVERVIEW

2.1 Project Background

The City of Almaty is the largest city in Kazakhstan with the population of about 2 million people it is located in south eastern Kazakhstan close to the border with China and Kyrgyzstan. The area to the south and east of Almaty is mountainous, and the local geography results in low wind speeds with inversion layers across the city a common occurrence (Kerimray et al., 2020 [1]). Inversion layers are characterised by low wind speeds and little vertical mixing resulting in ground level emissions being poorly dispersed, and high concentrations occurring at ground level. The geographical and meteorological characteristics combine with localised sources of emissions to produce generally elevated air pollution, and periodically high pollutant concentrations at ground level.

The effects of the inversion layer is illustrated in Figure 2-1. This image clearly shows the typical characteristics of the inversion layer with the polluted layer trapped at ground level hemmed in by elevated ground in the background, and the inversion layer overhead. In these circumstances ground level pollution concentrations will continue to build until a change in weather conditions will break up the near-ground level air column.

[1] Kerimray et al (2020) Spatiotemporal variations and contributing factors of air pollutants in Almaty, Kazakhstan *Aerosol and Air Quality Research 20 pp 1340-1352*

Figure 2-1: Typical Inversion Layer Over Almaty

Summary data for five monitoring stations operated by Kazhydromet's National Air Quality Monitoring Network (NAQMN) are set out in Table 2-1 from Kerimray 2020. Of note is that Station 12 is close to major roads and ambient concentrations are dominated by traffic emissions.

Table 2-1: Annual Mean Pollutant Concentrations base

Station	PM_{10} (µg/m^3)	SO_2 (µg/m^3)	CO (mg/m^3)	NO_2 (µg/m^3)
WHO Annual Mean Guideline	*70*	*50*		*40*
S1	43	12	1.59	130
S12	131	13	1.74	180
S16	96	15	1.38	130
S25	41	12	1.67	150
S26	58	13	1.32	130

IQAir [2] reported typical air pollution in Almaty, as summarised in Table 2-2.

[2] IQAir (2021) Air Quality in Almaty https://www.iqair.com/kazakhstan/almaty-qalasy/almaty

Table 2-2: IQAir

Pollutant	Concentration (µg/m^3)
$PM_{2.5}$	89.8
PM_{10}	110.9
NO_2	52.4
SO_2	5.7
CO	35.5

One specific comment on SO_2 is that Kazakhstan implemented a change in road fuel sulphur content in 2018, moving from 500ppm to 10ppm which will have reduced emissions from traffic sources. In light of these data the following are noted:

- Pollutant concentrations are variable throughout Almaty, depending on the location
- Pollutant concentrations vary by season
- The key pollutants of interest are PM_{10} and NO_2, and there is some evidence that in some locations SO_2 may also be elevated

The key sources of emissions in Almaty are summarised in Table 2-3.

Table 2-3: Key Source of Emissions

Source	Pollutant of interest	Fuel Type	Notes
Road traffic	NO_2 and $PM_{10}/PM_{2.5}$	Petrol and diesel	Petrol cars, and diesel cars and heavy vehicles
Industrial emissions	*NO_2, $PM_{10}/PM_{2.5}$, SO_2 and VOCs*	*Coal and gas*	*Coal and gas fired power generation*
Domestic emissions	NO_2 and $PM_{10}/PM_{2.5}$	Gas	Domestic heating and cooking
Transboundary pollution	NO_2, $PM_{10}/PM_{2.5}$, SO_2 and VOCs	Coal and gas	Power generation,
Natural sources	$PM_{10}/PM_{2.5}$		

There are several sources of data on the relative contribution of different sources to overall pollution in Almaty.

The Kazakh government provided a a Letter of the Prime Minister of the Republic of Kazakhstan dated February 22, 2021 No. 11-6/369 dz, This was a response to a grievance on the air quality in Almaty and Nus-Sultan submitted by a faction in the Kazakh Parliament.

The letter stated:

> *According to the calculations in 2019, the share of the pollution sources associated with heating in Almaty was 34% including CHP-2 (26% or 37.8 Kt) and CHPP-3 (8% or 11.7 Kt).*

The government and citizens of Almaty have approved a modernization of the CHP-2 boilers that allows to reduce emissions by 83% (current 37 Kt will be reduced to 6 Kt)

Furthermore, the government provided details of the current and future emissions from CHP 2, which is to be converted from coal fired to gas fired. The relative emissions of NO_x, SO_2 and carbon black (proxy for particulate matter) are set out in Table 2-4.

Table 2-4: CHP 2 emissions, present and future

Parameter	2019	After modernization (ca. 2025)
NOx, mg/Nm3	650	125
SO2, mg/Nm3	1,500	0
Carbon black, mg/Nm3	400	0

2.2 Location of CHP-2

CHP-2 is located in the western part of the city on two sites (see Figure 2-2: Location of CHP-2 industrial sites

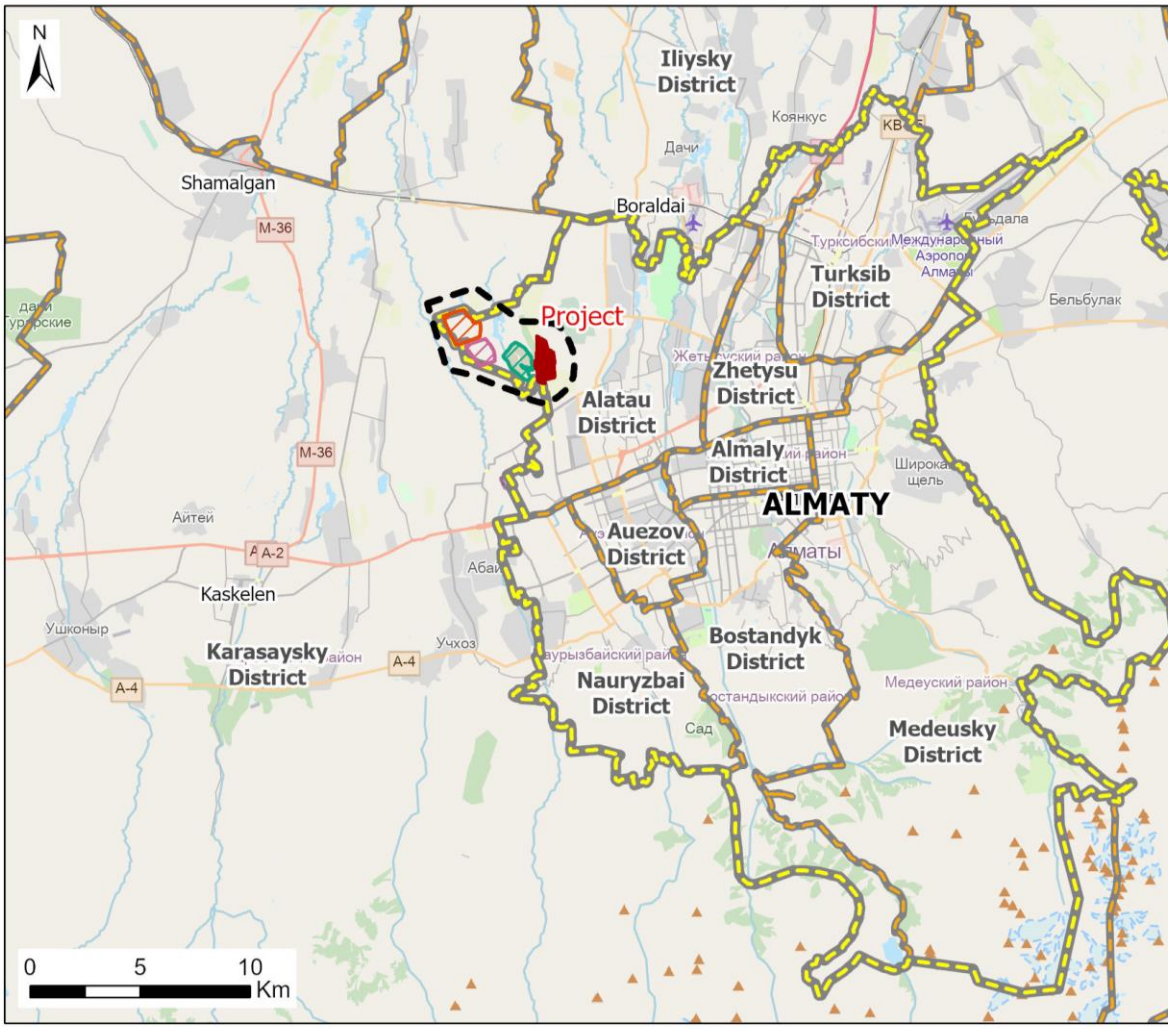


Figure 2-3). Main and auxiliary generating facilities are operating on the Site 1 (the industrial site, 93 hectares), Site 2 to the west is an ash dump (413 hectares). There are no legally protected areas of biodiversity value and monuments of history and architecture near the sites.

There are three dacha communities (gardeners' partnerships – "GPs") located near the CHP-2:

- Teploenergetik GP is located to the east of the ash dump at a minimum distance of 123 m;
- Energostroitel GP is located to the east-north of the ash dump at a minimum distance of 340 m.
- Bastau Nurka GP is located to the south of the ash dump at a minimum distance of 330 m.

Sanitary protection zone (SPZ) was established for each site: 1000 m for the Site 1 and 500 m for the Site 2, however in 2015 a unified 1000 m SPZ was confirmed for the CHP-2 and its facilities. New development allow for reasonable expectations of reduction of SPZ (details are provided in Section 2.4.10).

2.3 Existing Facilities at CHPP 2

CHP-2, located in the Alatau District of Almaty city, Kazakhstan (Figure 2-2: Location of CHP-2 industrial sites), is by far the larger plant with 8 coal fired power boilers, 7 steam turbines and related infrastructure and with total installed capacities of 510 MW and 1,411 Gcal/h. Currently, Ekibastuz coal is used as the main fuel at CHP-2, and fuel oil is used as a starting oil. Annual coal consumption is about 2.5 million tonnes.

The construction of the Almaty CHPP-2 named after A.Zhakutov began in 1974 with a design capacity of the first stage of 240 thousand kW., in order to increase the level of seismic safety, the station was buried 12 meters. For the first time in the country, boilers with a steam capacity of 420t/hour in seismic design were put into operation at the station.

In 1980-1983 , three steam boilers of the BKZ type were put into operation-420-140- 7C and three steam turbines of the PT-80/100-130/13.

Figure 2-2: Location of CHP-2 industrial sites

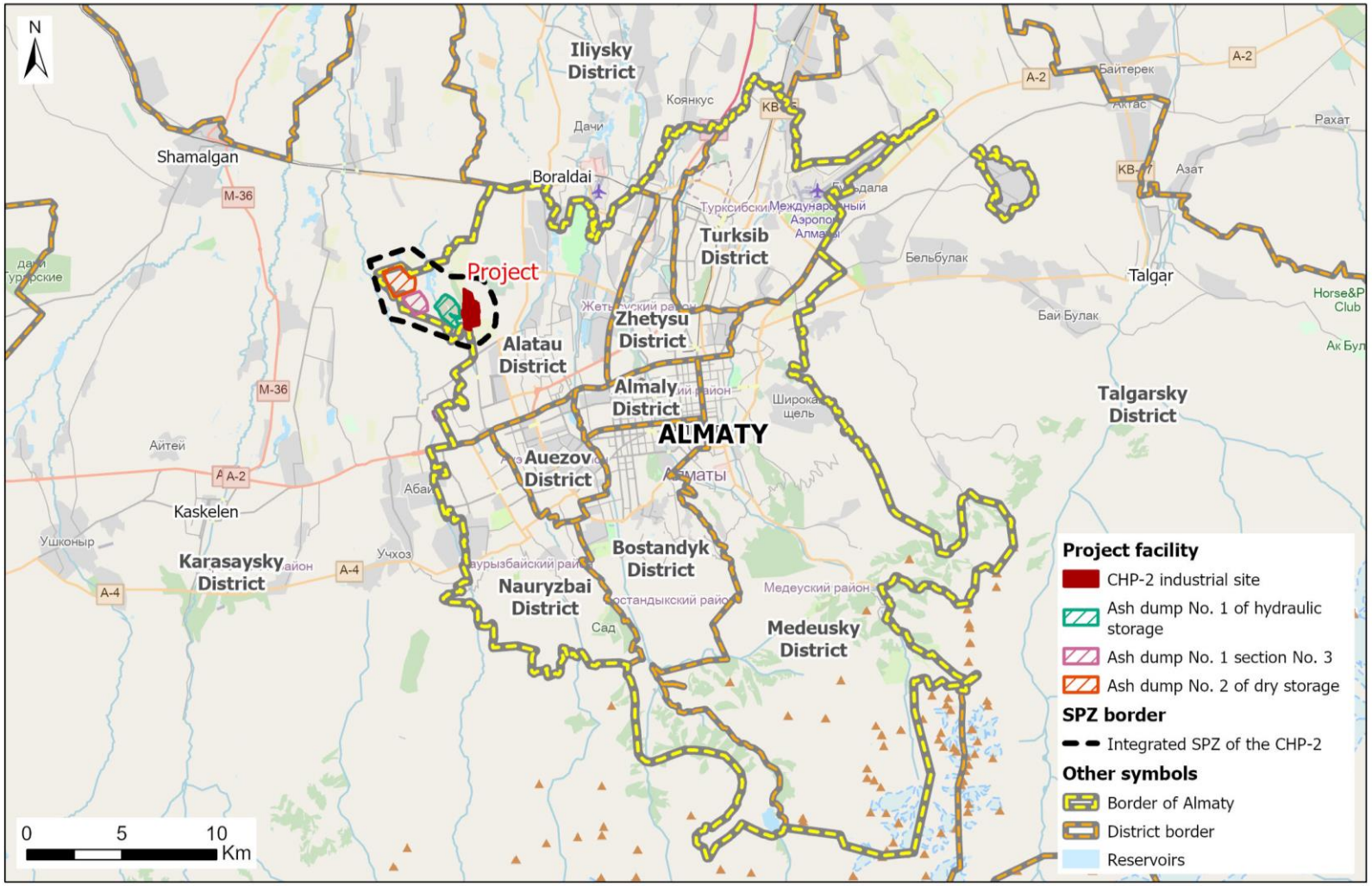
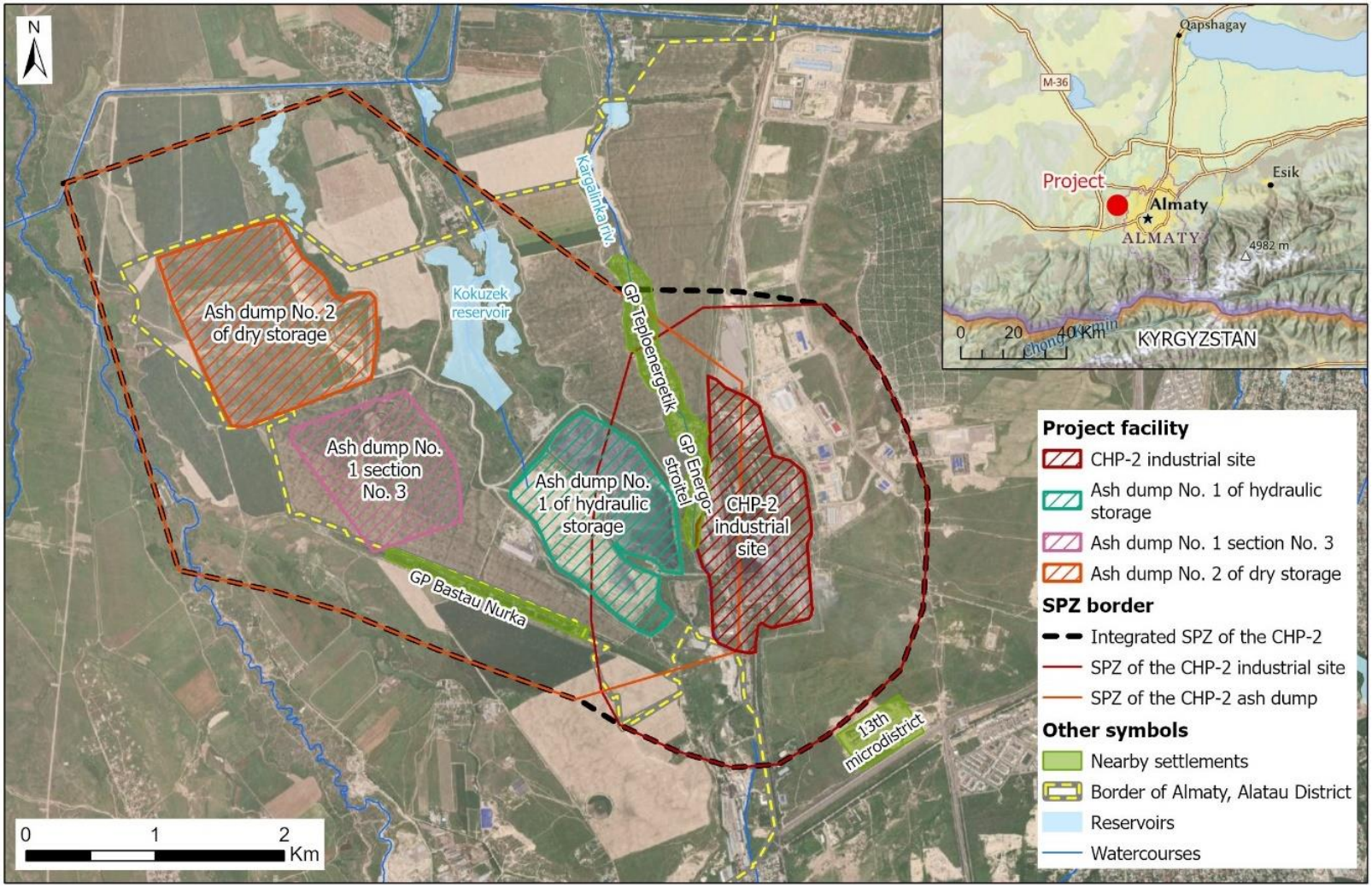


Figure 2-3: The Project site



The second stage of the construction phase was carried out in 1985-1989. During these years , four more BKZ steam boilers were put into operation-420-140- 7C, one steam turbine of type R-50-130/13 and two steam turbines of type T-110/120-130-5 . In 2016, boiler unit No. 8 of type E 420-13.8-560 KT was put into operation. The installed capacity of the station is:

- electric - 510 MW;
- thermal - 1411 Gcal/h.

The CHP operates according to a thermal schedule with additional power generation in the condensation mode.

Figure 2-4: Overview of the existing CHP-2 facilities during winter weather inversions

2.4 Planned Development

In cooperation with the local design Institute (KazNIIEnerogprom), JSC “AIES” has reviewed various alternative options for the modernisation and fuel switch from coal to gas of the CHP-2 and are currently finalising the selection of the preferred solution from a shortlist of 3 different combinations of combined-cycle gas turbine units, open-cycle gas turbines with Heat Recovery Boilers. The largest option provides for a total capacity of 620 MW electricity and 508 Gcal/h heat. The other two options provide slightly smaller capacities depending on the model and supplier of the equipment.

The Project will be developed in phases with the first phase a 200 MWe unit. The construction is planned to be carried out in two stages: 45.5 months for the 1st stage and 20 months for 2nd stage. The total duration of modernization of Almaty CHP-2 will be 65.5 months during 2022-2026. The estimated average number of construction workers will be 629 people. The maximum number of employees at a time will be 726 people in the peak year 2025.

CHP-2 will be modernized within the existing sites (Figure 2-5), additional land acquisition is not envisaged. Modernization will be performed so that existing equipment could be operated in parallel and be mothballed afterwards. CHP-2 will operate 24 hours a day throughout the year. The power

plant will provide heat for heating, ventilation and hot water supply during the heating period, and heat for hot water supply during the summer period.

Figure 2-5: General look of the existing CHP-2 facilities and upon modernization

Source:
1) https://www.gov.kz/memleket/entities/almaty/press/news/details/111769?lang=ru
2) https://assets.siemens-energy.com/siemens/assets/

Natural gas demand of the updated CHP-2 will be about 1,122.6 million Nm³/year.

To date the Project is on its initial stage of development, where analysis of alternatives has taken place and a pre-feasibility study with relevant pre-EIA (in line with legislation of the Republic of

Kazakhstan) has been developed. Following the requirements of national legislation public hearings of the Project were conducted, where the Project was supported by Almaty citizens (details are provided in Section 5).

JSC “AIES” has commited to comply with best international techniques and practices, as well as with EBRD requirements. Therefire any further Project developments (including engineering and construction works, environmental and social management during the construction and operation phases) will be aligned with relevant EBRD’s PRs. The said requirements will also be cascaded to EPC contractor and sub-contractors’ net and supply chain.

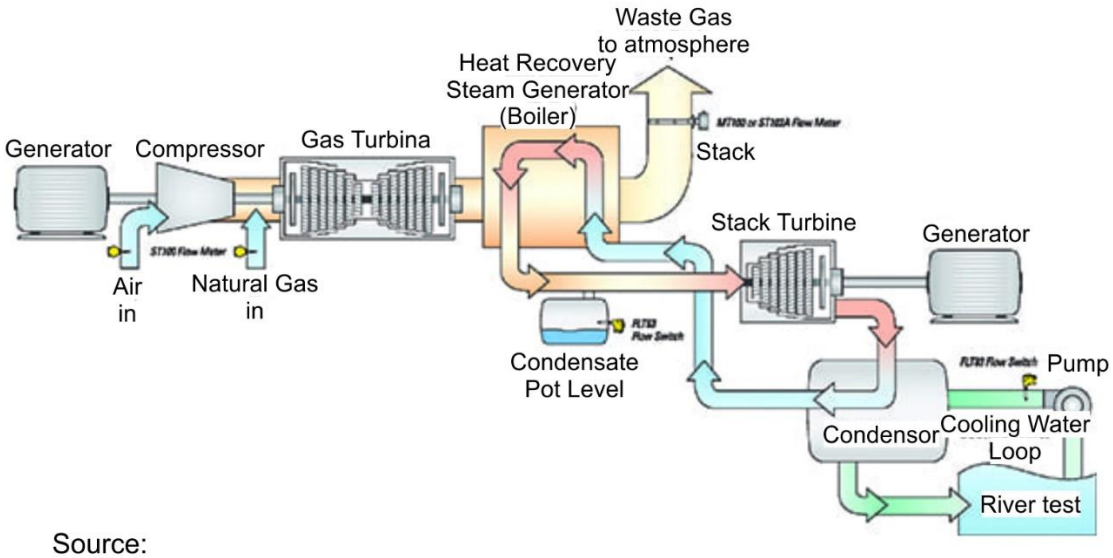
2.4.1 Main equipment

The configuration of the main equipment of gas turbine units in the recommended option is as follows:

- one combined-cycle gas power unit (CCGT) consisting of one SGT5-2000E gas turbine (SIEMENS), one heat recovery boiler E-224/66,7-7,9/0,46-508/210 (PJSC "ZiO") and one SST-600 steam turbine (SIEMENS);
- two gas turbine power units with cogeneration, each consisting of one SGT5- 2000E gas turbine (SIEMENS) and one hot water heat recovery boiler (PJSC "ZiO").

CHP-2 will operate 24 hours a day throughout the year. The power plant will provide heat for heating, ventilation and hot water supply during the heating period, and heat for hot water supply during the summer period (Figure 2-6).

Figure 2-6: Process flow scheme of the Project



Source:
https://www.powermag.com/plant-converts-to-combined-cycle-operation-with-help-of-thermal-mass-airgas-flowmeter/

Main Project characteristics are presented in Table 2-5.

Table 2-5: Project characteristics

Characteristic	Unit	Before modernization	After modernization
Installed capacity:	-	-	-
electrical	MW	510	557
heat	Gcal/h	1,411	957

Characteristic	Unit	Before modernization	After modernization
Operational capacity:	-	-	-
electrical	MW	312.8	535
heat	Gcal/h	952.0	816
Design heat load	Gcal/h	648.6	816
Electric power production	kWh/year	2,601,400,000	3,899,000,000
Electric power supply	kWh/year	2,213,000,000	3,742,000,000
Heat power supply	Gcal/year	3,241,100	4,020,000
Reference fuel consumption:	-	-	-
electric power supply	g/kWh	428.8	196
heat power supply	Kg/Gcal	133.3	142

2.4.2 Gas supply

The external gas supply system consists of the gas pipelines (Figure 2-7) from the tie-in points at the main gas pipelines to the CHP-2 fence.

Figure 2-7: External gas supply

Note: main gas pipelines are shown in red, supply gas pipelines as shown in magenta

The internal gas supply system of CHP-2 includes the following facilities:

- two supply gas pipelines from the CHP-2 fence to the gas treatment unit;
- gas treatment unit with two gas metering units with filtration, two gas control units and booster compressor units;
- gas pipelines at the CHP-2 site from the gas treatment unit to the new main building and the hot water boiler;

- on-site gas supply systems.

Natural gas demand of the updated CHP-2 is shown in Table 2-6.

Table 2-6: Natural gas demand

	Unit	Gas demand
Hourly gas demand	Nm³/h	201,614
Annual gas demand	million Nm³/year	1,122.6

2.4.3 Water supply

The main water source of the CHP-2 are artesian wells of the Talgar aquifer. The water is used to recharge the heating network and boilers, recharge the circulating system of technical water supply, and own needs of CHP-2.

During the modernization of CHP-2, the existing sources and water supply system will be preserved. Four independent circulating water supply systems are provided for cooling of the projected main and auxiliary equipment.

2.4.4 Wastewater treatment

The resulting production effluents of the CHP are supposed to be directed to the evaporation field on one of the sections of the existing ash dump. Due to the limited evaporative capacity of the evaporative field, separation and reduction of effluents are provided.

The following wastewater treatment and collection facilities are envisaged:

- oil-contaminated wastewater treatment plant of the main building and a hot water boiler with a capacity of up to 50 m³/h (two lines of 25 m³/h);
- neutralizer tanks of effluents from commissioning and operational chemical washing of boilers;
- the existing treatment facilities of oil-contaminated effluents, fuel oil storage facilities and fuel oil farms remain in operation.

2.4.5 Evaporation fields

Evaporation fields are envisaged within the area in sections No. 1 and No. 2 of ash dump No. 1 with an area of 120 hectares. No additional land acquisition is expected.

2.4.6 Construction management

The total duration of modernization of Almaty CHP-2 will be 65.5 months during 2022-2026. The estimated average number of construction workers will be 629 people. The maximum number of employees at a time will be 726 people in the peak year 2025.

The construction is planned to be carried out in two stages: stage 1 – 45.5 months, stage 2 – 20 months.

2.4.7 BAT Compliance

The Project declares its adherence to the European Union's Industrial Emissions Directive 2010/75/EU, which means that it will adopt the engineering and management decisions in line with the Best Available Techniques (BAT). BAT refers to the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of

particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole.

In this assignment, a high-level compliance analysis has been performed against the EU's BAT Reference Document for Large Combustion Plants. This analysis shows that the Project implements most of the applicable BAT. In particular:

- The strategy of the CHP-2 modernization is based on the minimization of the environmental impacts and emission abatement. This will be achieved by changing fuel to natural gas.
- NOX emissions will be abated by a set of measures. It is declared that NOX emission rates are going to be reduced more than tenfold to 50 mg/Nm3 which corresponds to the respective BAT Associated Emission Level.
- Emissions of SO2 and ash will be totally abated.
- After transition to natural gas, total GHG emissions of CHP-2 will decrease threefold, while specific GHG emissions per electric power and heat produced will decrease up to fivefold
- Project is going to implement water recycling which reduces the need for fresh water and

Project's compliance to BAT was stated at the early design stage and is declared in the Feasibility Study. Project's Environmental and Social Action Plan contains actions aimed at ensuring BAT compliance.

2.4.8 Expected emissions

Potential impact of the CHP-2 modernization on air pollution in the city of Almaty was assessed in the Feasibility Study using two criteria:

- comparison of absolute and specific emissions from CHP-2 by modernization options;
- the level of atmospheric air pollution based on the pollutant dispersion modelling results for each modernization option.

The Pre-ESIA (2020) provided a comparative assessment of the options according to annual (total) and specific emissions per ton of reference fuel. The assessment results (Figure 2-8) show that:

- Options 1 and 4, which use natural gas, provide for reduction in emissions by 80% against the level of 2019 by eliminating emissions of particulate matter and sulphur dioxide.
- Options 2 and 3, which use coal with gas cleaning equipment in boilers, provide for reduction in emissions by 60% and 70% against the level of 2019 respectively.

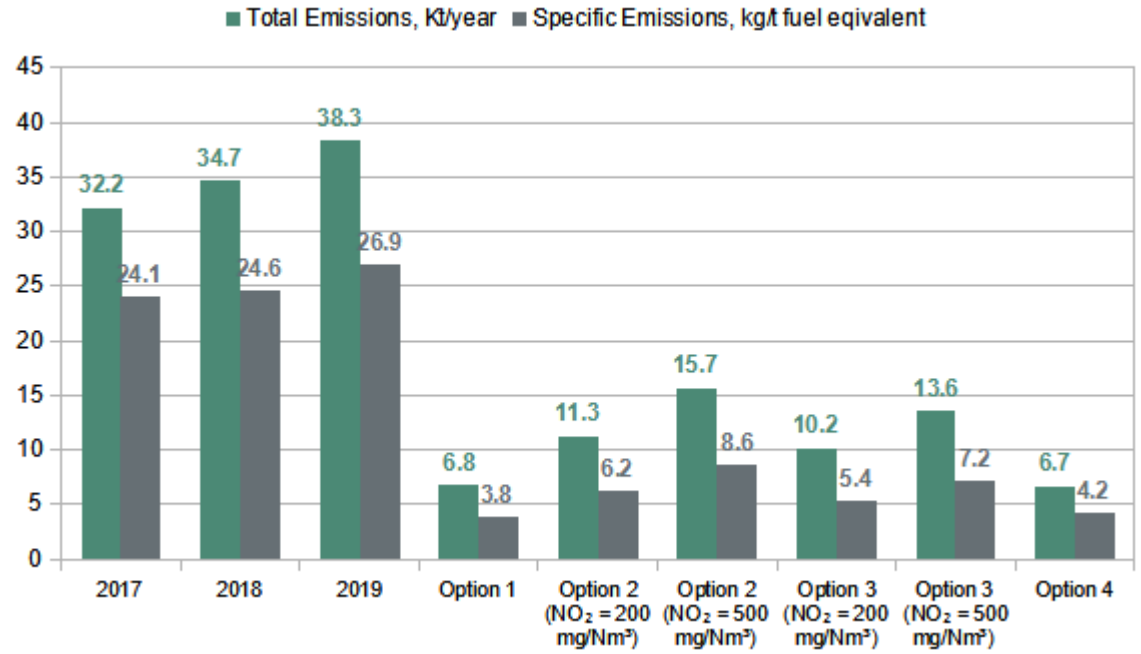
The modelling of the air pollution process associated with the CHP-2 emissions by modernization options was carried out in the Modernisation Project Feasibility Study. The modelling was based on the same scenarios that were used in modelling of existing emissions:

- maximum CHP-2 load/performance and adverse weather conditions (worst case scenario);
- annual average load on CHP-2 and annual mean meteorological parameters (most likely scenario).

The future baseline pollution was estimated according to the nationally recognized methodology.

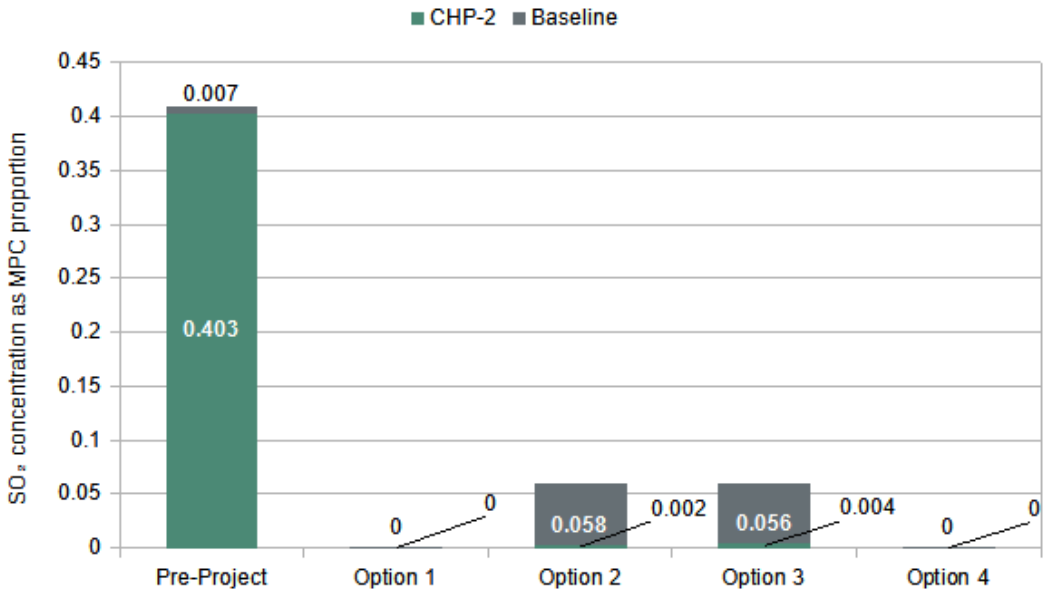
The modelling demonstrated that, even under the worst-case scenario, all options would meet national air quality standards for sulphur dioxide (Figure 2-9) and dust (Figure 2-10). The estimated concentrations of nitrogen dioxide (Figure 2-11) with consideration of the baseline level will be slightly higher than the established limit value; however, the input by the modernised CHP-2 in these concentrations will not be greater than 5%.

Figure 2-8: Pre-Project and with-Project emissions by options



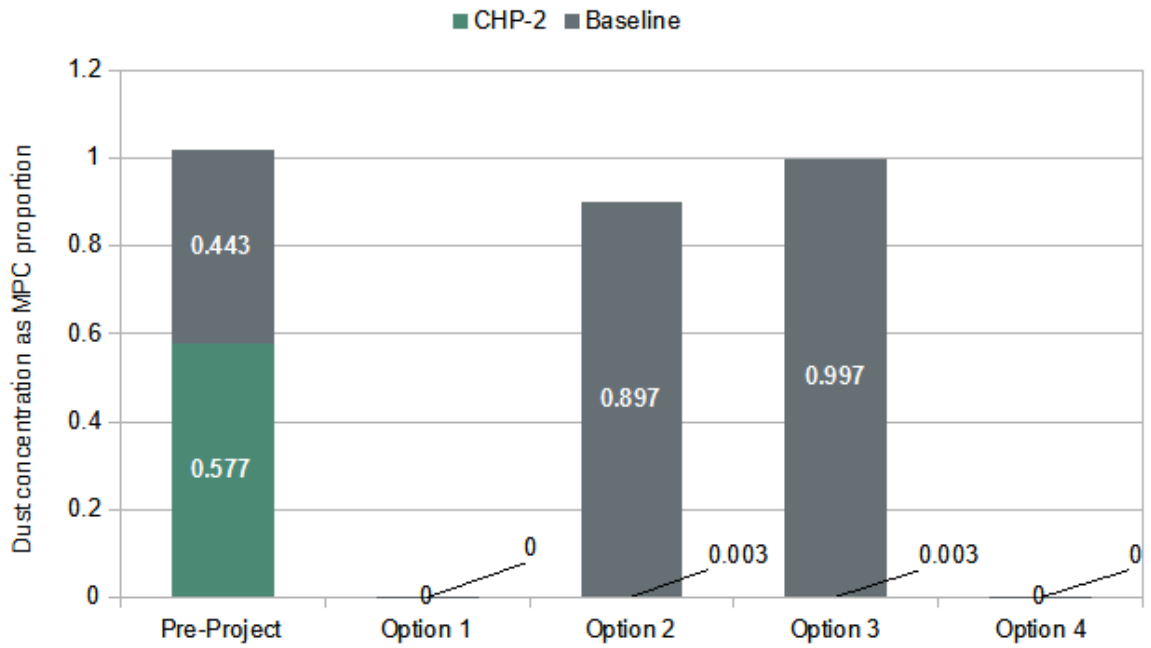
Source: Feasibility Study, 2020

Figure 2-9: Pre-Project and with-Project emissions of SO_2



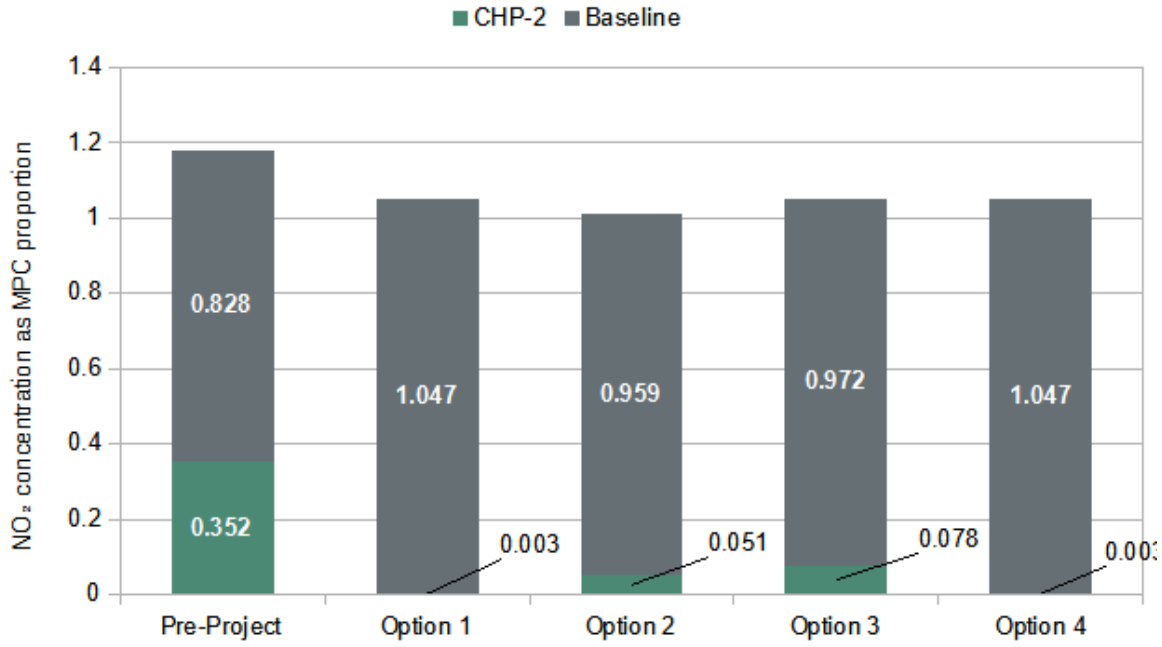
Source: Feasibility Study, 2020

Figure 2-10: Pre-Project and with-Project emissions of dust



Source: Feasibility Study, 2020

Figure 2-11: Pre-Project and with-Project emissions of NO_2



Source: Feasibility Study, 2020

2.4.9 Sanitary Protection Zone

Following the reduction of emissions of main pollutants discussed above it is reasonable to expect that concentrations of pollutants at the level below national standards of RoK will be observed quite close to the boundary of the plant.

During further Project development the SPZ can be reduced following the requirements of RoK within the following steps:

- Engineering design will consider feasible alternative project of SPZ to avoid or at least minimize physical and/or economic displacement of the closest garden partnerships during both construction and operation stages;
- Upon the development of the Project design documentation AlES will develop project of preliminary (calculated) SPZ based on the:
  - calculations of the ambient air pollution (taking into account baseline concentrations),
  - calculations of physical impacts (noise, vibration, electromagnetic radiation and other physical factors),
  - health risk assessment.
- Upon commencement of gas power unit into operation Conduct a one-year cycle of field studies and measurements to confirm the calculated parameters of preliminary SPZ:
  - Ambient air pollution,
  - Level of physical impacts:
  - noise,
  - vibration,
  - electromagnetic radiation,
  - infrasound,
  - scattered laser radiation,
  - other physical factors.
  - and (or) biological impacts.
- Develop established (final) SPZ based on:
  - project of preliminary (calculated) SPZ,
  - results of a one-year cycle of field studies and measurements.

Following EBRD requirements, the Project has developed Resettlement Framework, and a livelihood restoration framework will also be in place and any properties that are located withn a zone will be acquired by the Project if this is needed in 2026.

2.4.10 Emissions of greenhouse gases

According to the Feasibility Study, the recommended option for the modernization of CHP-2 will reduce greenhouse gas emissions by 1,354,000 t CO_2e/year not only by replacing fuel, but also by more efficient production, implying higher efficiency.

In this analysis, we have performed a high-level assessment of GHG emissions in accordance with the GHG Protocol methodology. This assessment has shown even higher reduction of the total GHG emissions compared to the one provided by the Feasibility Study (Table 2-7).

Table 2-7: Total GHG emissions

Activity data				GHG emissions, tonnes			
Fuel type	Fuel	Amount of fuel	Units	CO_2	CH_4	N_2O	All GHGs (tonnes CO_2e)
Solid fossil	Anthracite	2,500,000	metric tonne	6,561,525	6.7E+01	1.0E+02	6,589,927
Gaseous fossil	Natural gas	1,122,600,000	metre³	2,116,056	3.8E+01	3.8E+00	2,118,111

Specific GHG emissions per kWh and Gcal are expected to drop five- and four-fold respectively (Table 2-8).

Table 2-8: Specific GHG emissions

Fuel type	Fuel	Total GHG emissions (tonnes CO_2e)	Electric power supply	Heat supply	GHG emissions per kWh	GHG emissions per Gcal
Solid fossil	Anthracite	6,589,927	2,213,300,000	3,241,100	0.002977	2.03
Gaseous fossil	Natural gas	2,118,111	3,742,000,000	4,020,000	0.000566	0.53

Note: The analysis is based on limited available data. Calculations of the Consultant are based on the GHG Protocol methodology, which is not a regulatory methodology in Kazakhstan. In this regard, there may be discrepancies with the data presented in the reports of AlES within the framework of current operational activities, as well as those that will be clarified during the detailed design..

2.4.11 Preferable option

Based on the analysis of available technical details of the planned development, EBRD has confirmed that the Bank will finacioe option 1 or 4 rather than otions 2or 3. During discussion with AlES representatives it was also noted by EBRD that the costs of abatement of coal utnis will be externely high. Therefore the new invetsmnt will allow for the full elimation of coal from operation, however they still may be kept as cold reserve in case of emergency.

3. APPLICABLE STANDARDS

Legislative Framework	
■ Applicable Kazakhstan Environmental, Social, Health and Safety laws and regulations and permit requirements; and ■ Applicable international conventions, ratified by RoK (i.e. ILO).	 **Republic of Kazakhstan**
European Bank for Reconstruction and Development (EBRD) Environmental & Social Policy (2019) and associated Performance Requirements	
■ PR 1: Assessment and Management of Environmental and Social Impacts and Issues; ■ PR 2: Labour and Working Conditions; ■ PR 3: Resource Efficiency and Pollution Prevention and Control; ■ PR 4: Health and Safety; ■ PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement; ■ PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources; ■ PR 8: Cultural Heritage and ■ PR 10: Information Disclosure and Stakeholder Engagement.	European Bank for Reconstruction and Development
International Finance Corporation, World Bank Group Environmental, Health and Safety (EHS) Guidelines	

■ Environmental, Health, and Safety General Guidelines; ■ Environmental, Health and Safety Guidelines for Thermal Power Plants.	IFC International Finance Corporation World Bank Group WORLD BANK GROUP
Corporate Regulations of Samruk Energy	**Internal Regulations of JSC "AIES"**
SAMRUK ENERGY	АЛЭС

4. SUMMARY OF ENVIRONMENTAL AND SOCIAL IMPACTS

4.1 Reduction of Air emissions and Health Impacts

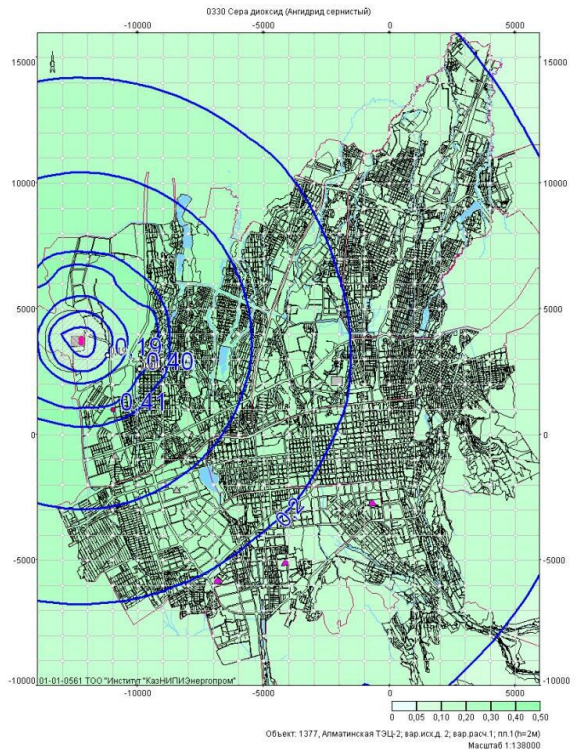
Almaty air quality is acknowledged to be poor, and pollutant concentrations are frequently in excess of Kazakh national standards and WHO air quality guidelines. This poor air quality leads to related negative impacts on the health of people living in the city.

Various health studies confirmed that strongest links between air pollutant concentrations and health outcomes are for cardiovascular diseases and respiratory diseases. Air pollution exacerbates both chronic and acute respiratory diseases, and can trigger new cases of chronic respiratory illness.

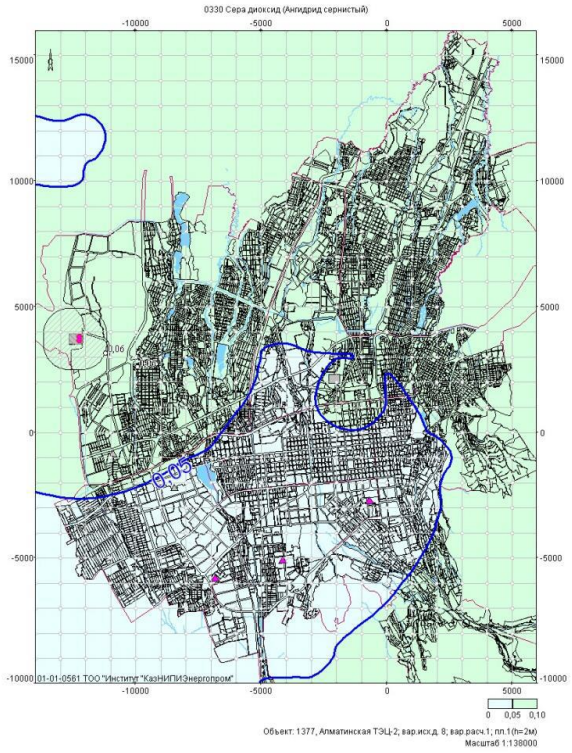
CHP-2 modernisation envisages fuel switch from coal to gas, which will allow to reduce air emission. Rough estimations shows that conversion to gas may lead to reduction of NO_x/NO_2 emissions by approximately 45%; $PM_{10}/PM_{2.5}$ and SO_2 emissions could be reduced to, effectively, zero as natural gas does not produce $PM_{10}/PM_{2.5}$ and SO_2 when burned. These numbers shall be verified during the ESIA study.

The worst-case dispersion maps for major pollutants are presented below.

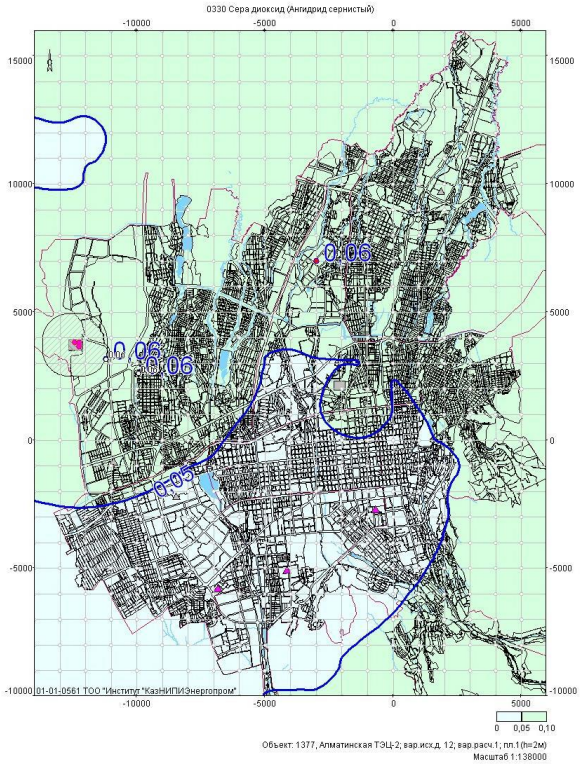
Sulphur Dioxide



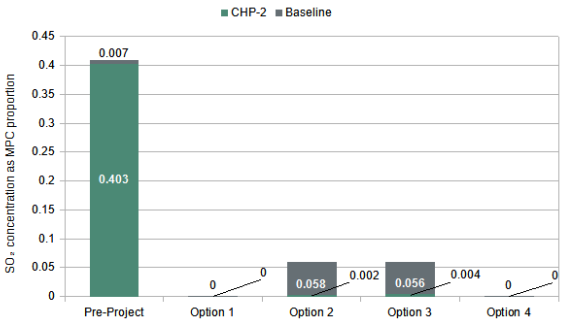
Pre-Project



Option 2 (coal)

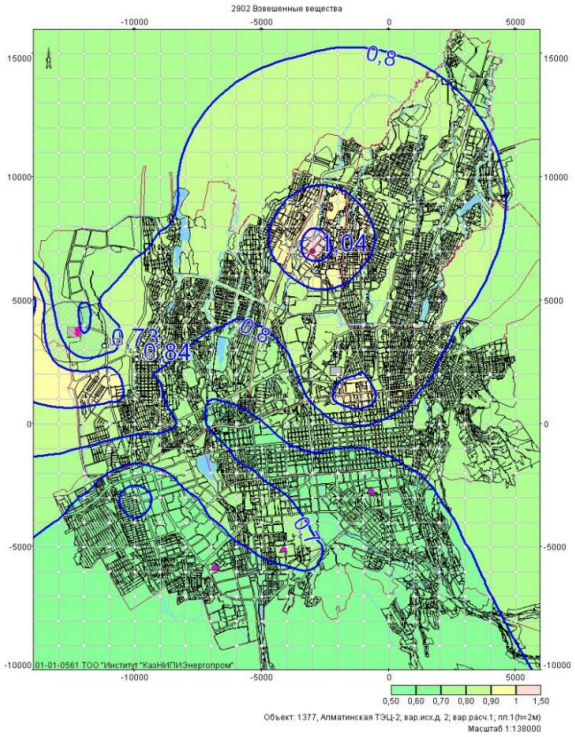


Option 3 (coal and gas)

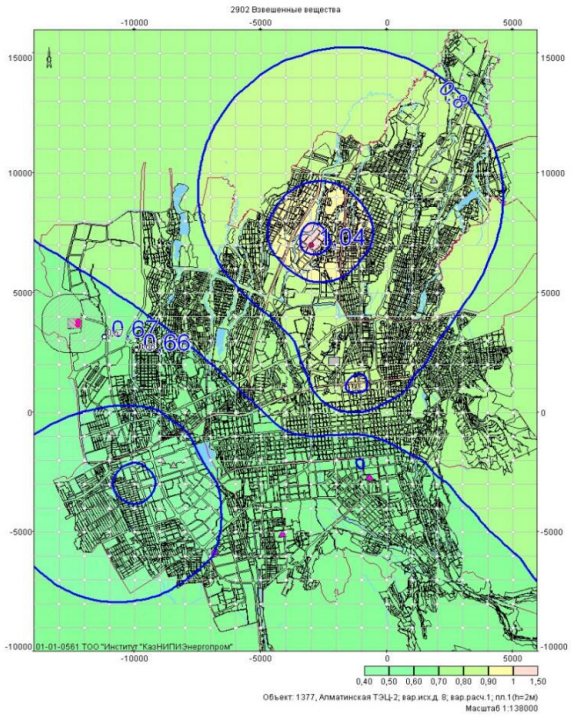


Maximum short-term SO_2 concentrations (MPC proportion)

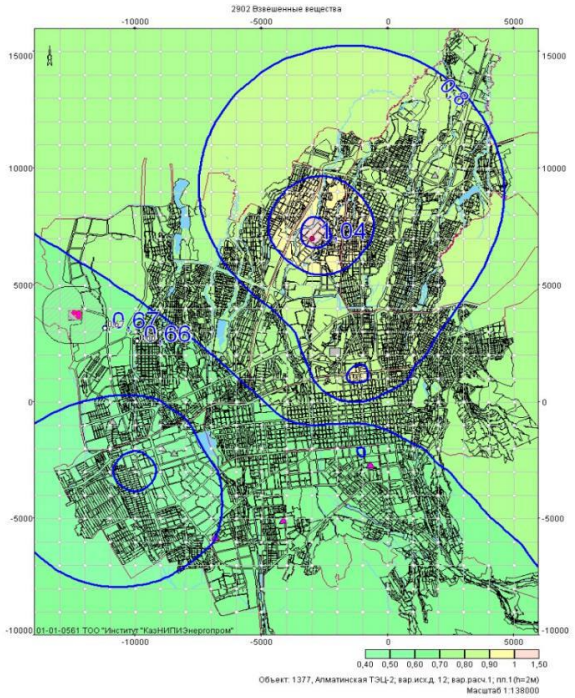
Coal Dust



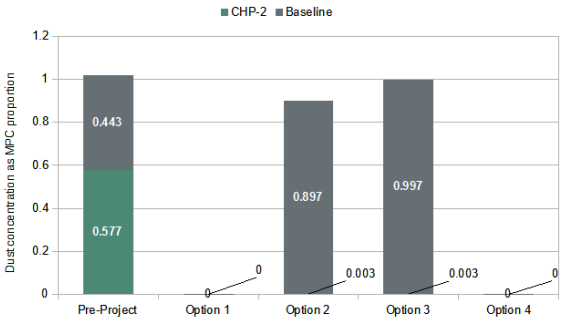
Pre-Project



Option 2 (coal)

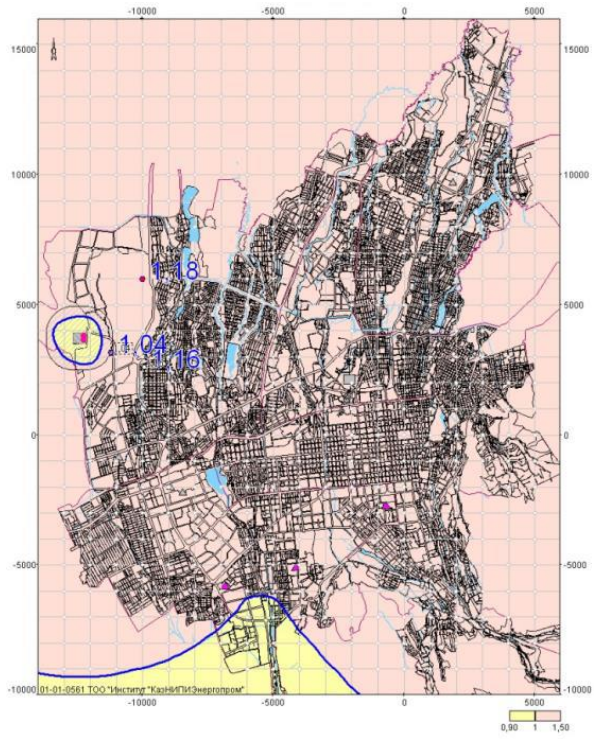


Option 3 (coal and gas)

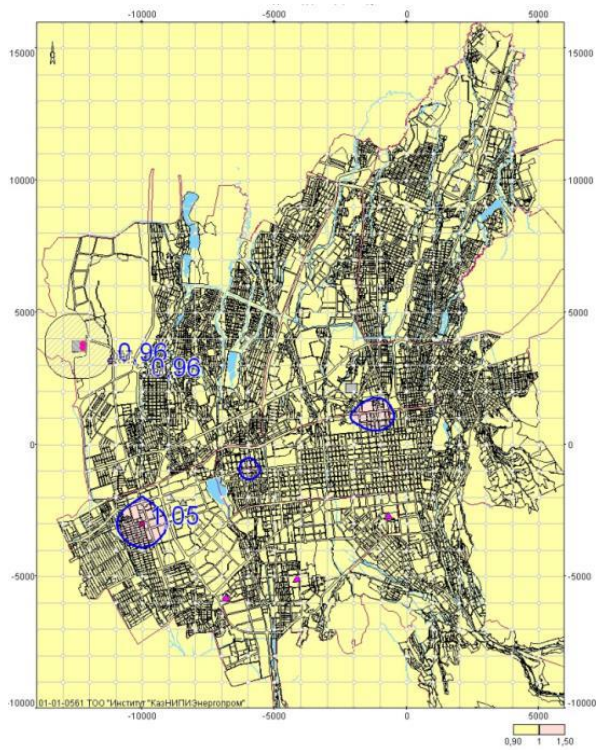


Maximum short-term dust concentrations (MPC proportion)

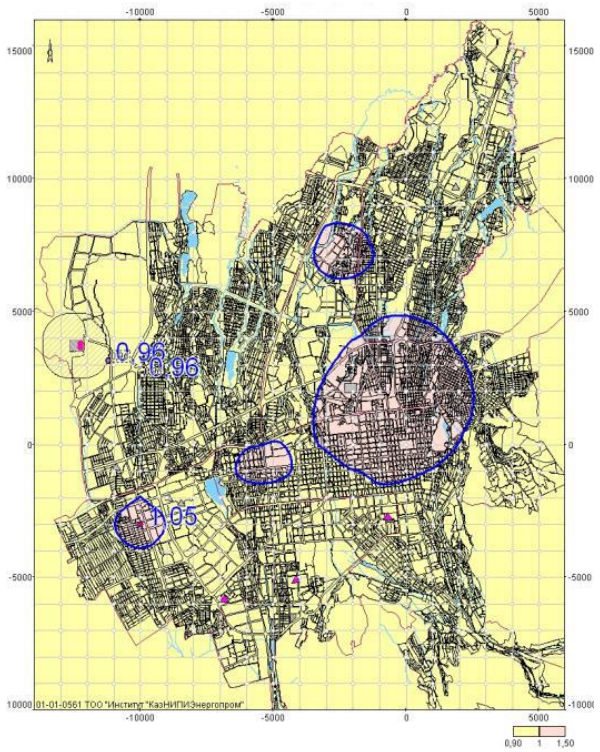
Nitrogen Dioxide



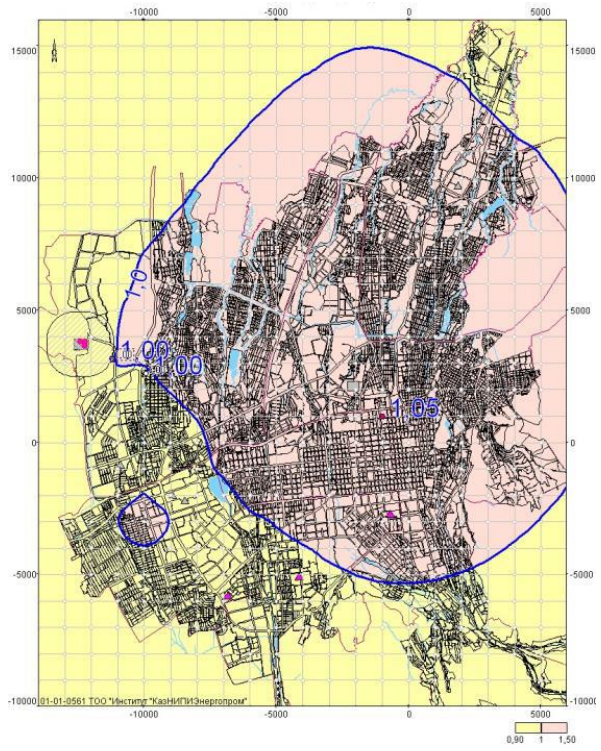
Pre-Project



Option 1 (gas)

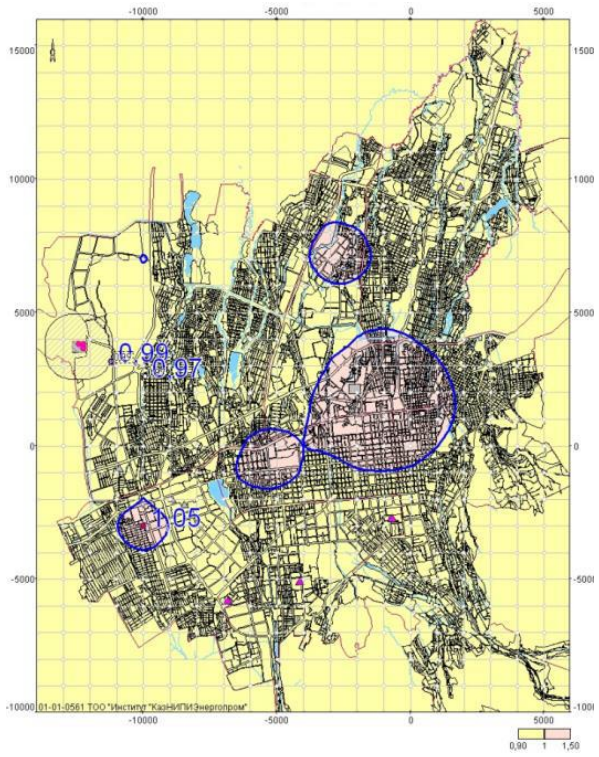


Option 2 (coal)

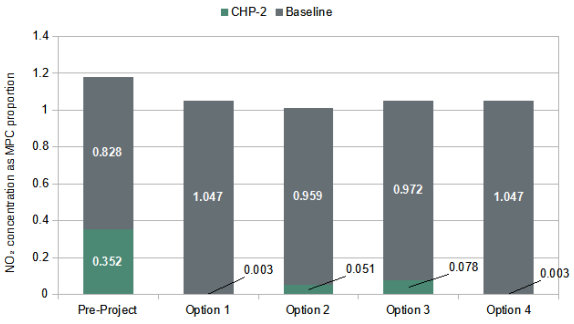


Option 3 (coal and gas)

Nitrogen Dioxide



Option 3 (coal and gas)



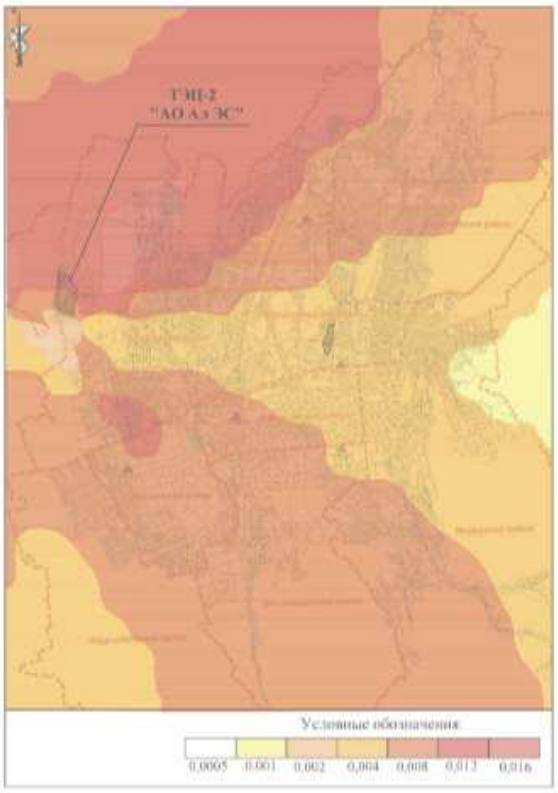
Maximum short-term NO_2 concentrations (MPC proportion)

It is expected that the decrease of air emissions will lead to subsequent decrease of adverse health outcomes, such as over-all mortality, lung cancer, asthma, chronic obstructive pulmonary disease, and diabetes. Reduction of adverse health outcomes will in turn lead to decrease of hospital admissions for both respiratory and cardiovascular problems, which will benefit to the overall accessibility of health services to local residents; and reduction of costs related to health services.

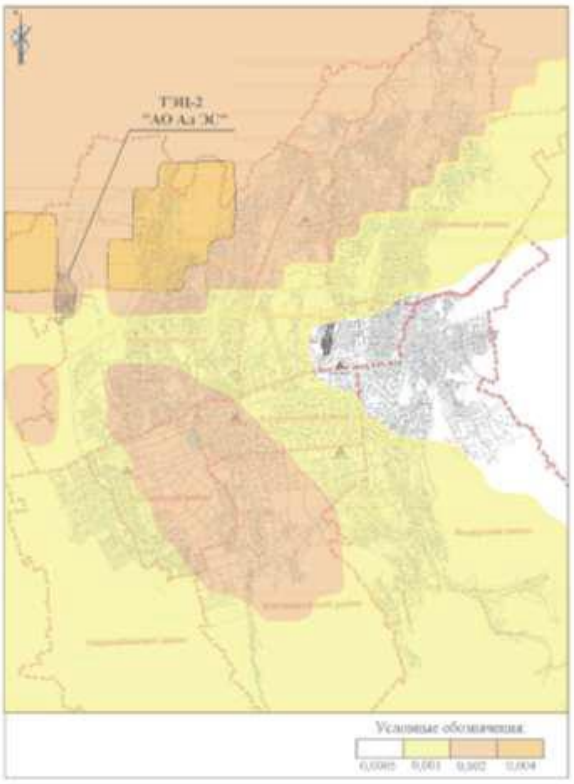
Potential impacts on community health were assessed in the Pre-ESIA (2021, developed in line with RoK requirements during pre-feasibility study). The main conclusions are as follows:

- The risk of non-carcinogenic acute impact is associated primarily with the high baseline air pollution in the city. Reduction of specific emissions of particulate matter at least by half against the current level (400 mg/nm³) is expected minimize the risk of non-carcinogenic acute impact of CHP-2 emissions on public health.
- The risk of non-carcinogenic chronic exposure is associated primarily with the high baseline air pollution in the city and, above all, with heavy metals. Negligible content of heavy metals in the fly ash from CHP-2 does not affect the risk of non-carcinogenic chronic exposure. The risk of non-carcinogenic chronic exposure, directly associated with the emissions of CHP-2, is minimal both at the current operation level and according to modernization options, regardless of the type of fuel.

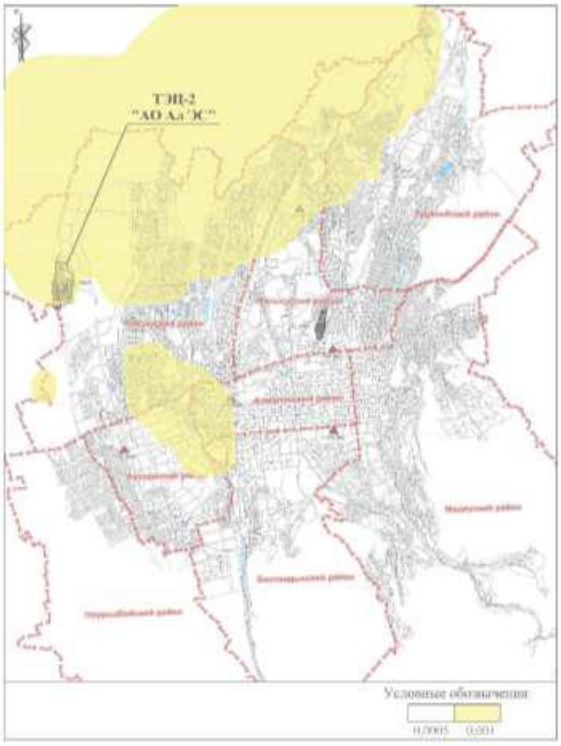
Below presented maps of the city zoning according to the level of risk of non-carcinogenic chronic effects of emissions from the existing CHP-2 (without background) and from the proposed coal and gas modernization options.



Pre-Project (current situation)



Coal modernization options



Gas modernization options

4.2 Impact on Climate and GHG Emissions

According to the Feasibility Study, the recommended option for the modernization of CHP-2 will reduce greenhouse gas emissions by 1,354,000 t CO_2e/year not only by replacing fuel, but also by more efficient production, implying higher efficiency. It also should be noted that the new unit in the future can be modified to use hydrogen as a main fuel. This is in full alignment with Paris Agreement adopted by the Republic of Kazakhstan and its obligation to achieve net zero carbon emissions by 2050.

4.3 Impacts of Physical Factors

Impact on noise background is not expected during operation phase and is expected to be locally limited during the construction phase. Recipients of the impact will be residents along traffic routes (please also refer to Section 4.8), residents of GPs close to the CHP-2 site and, potentially, residents close to construction quarries. The impact will be assessed in details within the ESIA studies and relevant mitigation measures will be implemented by the Project through the implementation of ESMPs.

4.4 Impact on the Environment (Natural Water, Topsoil, Terrain, Landscapes)

Since the Project will be implemented within brownfield, no direct negative impacts are expected during operation phase. On the other hand, similarly to positive impact on population's health, improvement of the environment is foreseen due to decrease of airborne pollution of ecosystems in Almaty and suburban.

Potential negative impact during the construction stage can occur due to activities on sites of associated facilities (e.g. gas pipeline (re)construction, development of the quarry for construction materials, etc.). These impacts will be identified and assessed within the ESIA, and when required, relevant mitigation measures will be included in ESMPs.

4.5 Impact on economy and labour market during the construction phase

As construction of the new facilities of CHP-2 will require engagement of temporal personnel (629 people in total with the maximum number of employees of 726 people), it may lead to increase of temporal jobs for the whole period of construction, which will benefit for the local labour market and incomes of local residents.

Construction stage of the Project will also require procurement of goods and services that to the certain extent may be obtained in local markets. This will induce multiplier effect that will correspond to the amount of goods and services procured from the local suppliers.

Environmental and Social Impact Assessment will consider these impacts and provide for enhancement measure in order to focus these positive impacts on local communities.

4.6 Labour and Working Conditions

JSC "AIES" developed and introduced a set of internal documents regulating labour and working conditions issues. These documents comprise HR management systems and includes HR Policy, Collective Agreement between JSC "AIES" and local Trade Union "Energy", procedures regulating individual personnel issues, such as hiring, transfer and dismissal of workers, job descriptions, Code of Conducts, etc. All of these documents are fully comply with national legislation. Collective agreement in turn provides additional benefits and social guarantees to JSC "AIES" workers which exceeds provisions of the Labor Code.

Minor discrepancies between HR documents and EBRD PRs will be covered as a part of the Environmental and Social Action Plan (ESAP) implementation. For instance, ESAP provides for update of existing procedures to covers such topics as human rights protection and women empowerment, development of new additional procedures, such as long-term program for minimization of harmful factors, and development of Collective Dismissal Plan (see Section 4.7 below).

In addition to the listed updates of HR management system, a Grievance Redress Mechanism for workers will be updated to ensure that it comply with EBRD PRs, easily accessible for every worker, transparent, effective, confidential process that provides timely feedback to those concerned, without any retribution. For additional details, please refer to the standalone Stakeholder Engagement Plan.

4.7 Collective dismissals

Modernization of CHP-2 may require dismissal of a significant number of personnel. The national legislation regulates collective retrenchment process and provides workers with certain safeguards to protect their rights during retrenchment, such as advance notice, monetary compensation, job transfers, etc. There are 665 worker currently employed at CHP-2.

JSC "AIES" adopted corporate procedure for hiring, transferring to other departments and retrenchment and has experience in retrenchment of personnel due to modernization of its power plants. For instance CHP-1 caused retrenchment of 70 people, which has been transferred to other jobs within the JSC AlES. However, modernization of CHP-2 will likely cause the need to reduce a larger number of personnel; at the time of report there were no information on the scale of planned dismissals. It is preliminary estimated, that transfer of personnel to other jobs after the implementation of the Project won't cover all projected staff reduction.

Given the previous JSC "AIES" experience in collective dismissal, it is expected that the Company will be committed to preserve its workers and provide them with all possible opportunities to alternative employment, however, the larger scale of the current Project will likely result in retrenchment of more than 30 workers, which, in turn trigger EBRD PR2 requiring development of Collective Dismissal Plan.

In this regard, the Company shall develop a Collective Dismissal Plan, which will clearly state workers rights to compensation, supporting measures and will be disclosed to interested parties prior its finalization.

4.8 Tariff increase

Modernization of the CHP-2 is an investment project, which require allocation of finance to cover costs of new facilities construction. It is expected, that allocation of the finance will be partly covered by the increase of electricity and heat tariffs for the Almaty citizens, while options of such increase is still under the discussion on the national level.

Since the Project provides for significant reduction of environmental impacts in the city and is of high importance to the health and safety of the Almaty citizens, the option to spread the increase in tariffs among the whole Kazakhstan rather than Almaty is being discussed on the republican level.

4.9 Local impacts on dachas communities

There are three dacha communities located within the currents CHP-2 SPZ boundaries: Teploenergetik, Energostroitel and Bastau Nurka. These communities are the closest residential areas to the Project site and in this regard will experience impacts, related to the process of CHP-2 modernization and future operation, to the larger degree than other residential areas of Algabas microdistrict.

National legislation of Republic of Kazakhstan[3] prohibits location of residential buildings within the boundaries of SPZ. In this regard, the Project will require to establish new SPZ in accordance with the provisions of national laws, including development of the preliminary (estimated) SPZ, which shall be further confirmed by the field monitoring.

Currently there are 184 residential buildings in the Teploenergetik GP, 109 – in the Energoctroitel GP and 100 – in Bastau Nurka GP. The exact number of households falling into the boundaries of new SPZ shall be identified during the census of affected land users based on the preliminary (estimated) SPZ parameters.

Significant impacts will be related to the construction activities on the Project site, movement of construction equipment, transportation of cargoes and presence of the construction workers. Such impacts will include increase of dust, noise and nuisance during the active phases of construction. However, modernization of the CHP-2 will allow to reduce the level of emissions, which eventually will result in improvement of ambient air quality.

As these dacha communities are partly located within the SPZ, a Resettlement Framework was developed as a part of the ESDD. The Resettlement Framework provides for overview of compensation entitlements for each category of affected land users. During the further stages of the Project a Resettlement Plan will be developed and disclosed to interested parties before finalization. Additional measures aimed at mitigation of impacts on local residents of these dacha communities will further determined based on the outcomes of the Environmental and Social Impact Assessment.

4.10 Local impacts due to operation of quarries and transportation of Project cargoes

Construction of the CHP-2 will require certain amount and different types on construction materials, which will be supplied from the local quarries (sand and gravel, etc.) and will be transported to the Project site via local roads.

The main impacts on local residents in this regard will be dust and noise due to quarry activities and transport movement, increased traffic, risk of road accidents and deterioration of road quality. These impacts will be further assessed as a part of full-scale Environmental and Social Impact Assessment (ESIA) and will be mitigated by the set of measures corresponding to the level of impact significance.

4.11 Emergency preparedness and response

The H&S and emergency preparedness activities are supported by the Company's Management System which is based on the local (national) legislation and ISO 450001 and complies with the international practice.
Samruk Energy, the Parent Company has developed an Emergency Response Plan as part of ensuring preparedness for emergency response, however it requires certain update and improvements.

The Company has assigned personal responsibilities for labor safety and emergency preparedness in compliance with the national law. The appointed employees are provided with the necessary resources and trained in accordance with the requirements of the national legislation and internal standards of the Parent Company, Samruk Energy. However, the appointed employees have not received training in the EBRD Standards yet.

Operation of the modernized CHP-2 will not require any significant changes to the existing H&S and Emergency Preparedness function (rather than staff reduction and relevant decrease in headcount of

[3] Sanitary Rules "Sanitary and epidemiological requirements for sanitary protection zones of objects that are sources of impact on the environment and human health", approved by the Order of the Acting Minister of Health of the Republic of Kazakhstan dated January 11, 2022 No. KR DSM-2

H&S team). As composed to date, H&S service can't satisfy needs for the safety of construction and installation works.

5. STAKEHOLDER ENGAGEMENT

5.1 History of Stakeholder Engagement

Public hearings on the preliminary EIA report for the Project were held on November 29, 2021 at 3 pm in Almaty. In total 86 participants attended public hearings, including representatives of the Company, local mass media, NGOs, Almaty Akimat and Almaty citizens. Notification on the hearing has been published via several sources:

- On the Company website (http://www.ales.kz/ru/novosti-kompanii/155-2021-god/1874-ob-yavlenie-o-provedenii-obshchestvennykh-slushanij-2) on October 25, 2021;
- On the Unified Environmental Portal (https://ecoportal.kz/);
- On the Department on the Green Economy website (https://www.gov.kz/memleket/entities/almaty-eco/press/article/details/65461?lang=ru) on the October 26, 2021;
- On the information stand in the Public Reception of the Akim Office of the Alatau District of Almaty;
- In the "Almaty aqshamy" newspaper, #129 (6105) on the October 26, 2021;
- In the "Vecherniy Almaty" newspaper #129 (1390) on the October 26, 2021
- On the "Almaty" TV channel on the October 26, 2021.

Minutes of meetings have been disclosed at the Akimat website[4].

During the meeting the following topics have been discussed:

- Major Project solutions by AO "Institut "KazNIPIEnergoprom" (Pre-feasibility study of the Project with general technical solutions);
- Report on the possible impacts by AO "Institut "KazNIPIEnergoprom" (Pre-EIA Report).

Participants of the meeting raised several questions regarding the Project implementation, associated with the following topics:

- Project schedule and duration of the construction phase;
- Costs of the Project implementation;
- Technical solutions related to the duration of the construction phase, construction solutions, filtration system, etc.
- Changes in tariffs for heat and electricity due to Project implementation;
- Impact on environment, especially on the groundwater, and nearby residential neighborhood, and other.

During the hearings representatives of the Company and design team provided answers to all questions, which is reflected in the minutes of the meeting.

[4] Source: https://www.gov.kz/uploads/2021/11/30/28656ad1a5f8019bf23388f9443ffded_original.20343344.pdf. Date of reference May 24, 2022

5.2 Stakeholder Engagement and Project Disclosure at Current Stage

Within the ESDD framework the Project specific Stakeholders Engagement Plan (SEP) has been developed, including preliminary identification of Project stakeholders groups, description of Disclosure package (please refer to Section 5.2) and preliminary stakeholder engagement program.

The following stakeholder groups have been preliminary identified:

- Local residents living near the Project site and related infrastructure, including: Energostroitel GP, Teploenergetik GP, Bastau Nurka GP, Alatau District of Almaty City, Karasaysky District of Almaty Region, other districts of Almaty City;
- Authorities and supervisory bodies;
- Non-governmental organizations and independent experts;
- Mass- media and communications;
- Organisations specialising in training and recruitment;
- Organisations involved in the Project implementation and subcontractors;
- Project staff;
- Beneficiaries of the Company's social programmes;
- Vulnerable groups.

This NTS as well as other materials of Gap Analysis study will be disclosed to the public prior Project approval by EBRD. The set of documents that are subject to disclosure are as follows:

- Gap Analysis report;
- Environmental and Social Action Plan;
- Stakeholder Engagement Plan;
- Resettlement Framework;
- Non-technical Summary.

Hardcopies of the Gap Analysis materials will be available in the **JSC "AIES" office, Dostyk avenue, 7, Almaty, 050002.**

The documents will be also available for download on the Project website: **http://www.ales.kz/**.

JSC "AIES" and CHP-2 contact information is presented on the Company's website and listed below:

- JSC "AIES", tel: **+77272540331**, fax: +77272507974;
- Almaty CHP Plant 2, tel: +**77272503140**, fax: +77272503155.

Stakeholders can send a request or complaint by e-mail: **kancel@ales.kz**.

5.3 Further Stakeholder Engagement

Public hearings on the preliminary EIA report for the Project were held on November 29, 2021 at 3 pm in Almaty. Additional consultation will be held as a part of the ESIA process on further stages of the Project development.

Such consultations will include at least the following:

- Consultation with key stakeholders such as local authorities, NGOs, local organizations, affected parties, etc. to obtain socio-economic baseline information, which will serve as the basis for the further Environmental and Social Impact Assessment study;

- Several rounds of consultations with dacha communities regarding development and disclosure of resettlement documents;
- Consultations with redundant workers and Trade Union regarding development and disclosure of retrenchment program and related documents;
- Several rounds of public hearings on Scoping study and full-scale ESIA in local communities to discuss identified impacts and mitigation measures that will be implemented by the Project.

Apart from the consultations, Stakeholder Engagement Plan also provides for implementation of internal procedures, such as hiring of additional personnel, adoption of new stakeholder engagement documents, including Grievance Redress Mechanism (please refer to the section 7 below), update of the Project website, disclosure of Project-related documents, announcements on the upcoming consultations, press-releases, etc.

For additional details on the stakeholder engagement program, schedule of activities and responsible parties please refer to Stakeholder Engagement Plan. This Plan will be further updated as the Project develops and provide for description of any stakeholder engagement activity associated with the Project implementation.

6. ENVIRONMENTAL AND SOCIAL ACTION PLAN

The review of the Project has been conducted to confirm its compliance with both national requirements and EBRD Project Requirements. The Gap Analysis report presents the areas for improvement and an Environmental and Social Action Plan (ESAP) is developed and adopted by the Company. The ESAP provides organizational and design measures to ensure the Project compliance with EBRD PRs, including the following:

- Conducting a fell-scale Environmental and Social Impact Assessment (ESIA) of the Project;
- Adhering compliance with Best Available Techniques (BAT) for thermal plants;
- Provide for strong management of environmental and social aspects of the Project implementation during both construction and operation phases, including management of contractors of all levels and supply chain;
- Engaging stakeholders pro-actively throughout all Project phases following the requirements of the Stakeholder Engagement Plan (Section 5), considering feedback and regular SEP update and adoption for the Project needs;
- Embedding Grievance Redress Mechanism (Section 7) in the Company's Environmental and Social Management System (ESMS) as a major priority. The GRM will be functioning for both external (communities, NGOs, etc.) stakeholders and internal (workers, contractors, subcontractors and their workforce, both permanent and short term) stakeholders.

7. GRIEVANCE REDRESS MECHANISM

Based on the information provided by the representatives of the Company, there are several channels to submit a grievance are available to stakeholders:

- Samruk-Energy Hotline[5];

[5] http://www.ales.kz/ru/contact-info/2-uncategorised/749-goryachaya-liniya-gruppy-kompanij-aktsionernogo-obshchestva-samruk-azyna

- The helpline of the Ombudsman of JSC "AlES";
- JSC “AlES” telephone (+77272540331) and email (kancel@ales.kz);
- CHP-2 telephone (+77272503140);
- Through akimat (mostly environment-related issues).

In order to ensure compliance with the EBRD requirements, it is necessary to update current GRM and unify approach to grievance resolution, ensure its transparency and effectiveness. The Project specific GRM will include the following stages:

- *Stage 1. Receiving a request or grievance:* All requests or grievances received shall be documented and recorded in an electronic database – the Grievance Log. The database shall be linked to all channels of grievance submission.
- *Stage 2. Categorization the request/grievance and forwarding it to appropriate unit of the Company*: The request or grievance received shall be referred to a particular category, depending on its type and severity. If the request is not a standard one or a grievance has been received, it shall be forwarded to the head of the corresponding unit. If necessary, the request / grievance may be forwarded to the senior management. Officers responsible for dealing with requests or grievances coordinate the grievance review process within the Company.
- *Stage 3. Initial Responses:* An initial response is sent to the complaining individual or organisation within 3 days from receiving the request / complaint (1 day in the event of critical grievance). The initial response describes the way the request or grievance will be handled.
- *Stage 4. Review and Resolution Proposal*: The review results are submitted to the head of the unit or senior management for consideration. The decision making process may include consultations with the persons or organizations involved.
- *Stage 5. Resolution Notification*: Following the review and decision-making process, the resolution is sent to the complainant and to all other parties involved.
- *Stage 6*. *Agreeing (or disagreeing) with the Proposed Resolution*: Having sent the response, the Company shall contact the complainant and all other parties involved to find out if the proposed resolution is satisfactory. If the complainant does not respond to the Company within 30 days after receiving a response from the Company, the request / grievance is treated as satisfactorily resolved.
- *Stage 7*. *Follow-up and assessment:* Every grievance resolution is subject to a follow-up and assessment of its effectiveness. The results of the grievance analysis shall be presented in the form of the monthly report and taken in consideration during the GRM effectiveness assessment.

Grievances are to be processed as soon as they are received/ collected in the field, on a case-by-case basis, and depending on the priority of the case. Priority is given to grievances that require immediate action to resolve the problem, e.g. grievances about emergencies, accidents and hazardous working conditions (**Ошибка! Источник ссылки не найден.**).

Table 7-1: Timing of grievances and requests processing

Subject	Timeframe for response
Construction phase	
Emergencies and accidents during construction	Immediately
Unsafe conditions, decline in safety, noise and dust pollution, employee behaviour, traffic	1-2 days

Subject	Timeframe for response
Other issues, comments	30 days
Operation phase	
Safety issues	1-2 days
Other issues, comments	30 days