JOINT IMPLEMENTATION PROJECT

Effective utilization of the blast-furnace gas and waste heat at the JSC «Zaporizhstal», Ukraine

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CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Effective utilization of the blast-furnace gas and waste heat at the JSC "Zaporizhstal", Ukraine

Sector: (1) Energy industries (renewable/non-renewable sources)

Version: 04

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A.2. Description of the project:

The JSC "Zaporizhstal" is implementing the project directed at the effective utilization of the blast-furnace gas by means of construction a turbogenerator with the capacity of 35 MW and the effective use of the waste heat due to the reconstruction of the heat networks supplying heat to the customers of Zaporizhia.

Situation existing prior to the starting date of the project:

Subproject – blast-furnace gas utilization

Blast-furnace gas is produced by the blast-furnaces of the JSC "Zaporizhstal" and is used by the units of the JSC "Zaporizhstal" as a fuel. The main consumers of the blast-furnace gas are the air heaters of the blast-furnaces and the combined heat and power plant (CHPP) of the JSC "Zaporizhstal". Due to the fact that the blast-furnace gas is produced in a very large amount, more than all units of the metallurgical works can use, the redundant gas is flared. The CHPP of the JSC "Zaporizhstal" is produced electric power and the heat which are supplied to the main productive units of the works. As a fuel in the CHPP are used the natural gas, the blast-furnace gas (produced by the blast-furnace shop), coke oven gas (supplied by the JSC "Zaporizhcoks") and the fuel oil (used as a reserved fuel). The CHPP of the JSC "Zaporizhstal" has the turbogenerator with the available capacity of 18 MW, and this permits to produce the electric power in the amount of up to 150,000 MWh per year. The CHPP of the JSC "Zaporizhstal" provides the units of the works with thermal energy in the required quantity. Nevertheless, the CHPP of the JSC "Zaporizhstal" covers less than 10% of electricity demand; the other part of the electric power for the demand of the JSC "Zaporizhstal" is supplied by the energy grid of Ukraine.

Subproject – waste heat utilization

The waste heat is formed in the evaporation cooling systems (ECS) and in the waste-heat boilers (WHB) of the blast-furnaces and the open-hearth furnaces at the JSC "Zaporizhstal". In the cold time of a year (from November to March) the waste heat is used to heat the water in the heating units (HU). The hot water is used to heat the working area. In the warm time of a year (from April to October) the JSC "Zaporizhstal" did not used the waste heat before the project on the reconstruction of the heat networks to supply the heat to the outside consumers started. The waste heat from the ECS was thrown into the atmosphere and the WHB were taken out of service. Before the project on the reconstruction of the heat networks at the JSC "Zaporizhstal" started and before the JSC "Zaporizhstal" started supplying the heat power (hot water) to the consumers of the city of Zaporizhia, the consumers of the heat power were supplied the heat power (hot water) by the city boiler plants working on the natural gas.

Project scenario

Project scenario allows to effective waste energy utilization for electricity and heat power production. The project scenario is in compliance with relevant host party legislation for energy and energy efficiency.[1]

[1] Energy strategy of Ukraine to 2030, approved by Ministry Cabinet of Ukraine 21.03.2006

Subproject – the blast-furnace gas utilization

The project scenario includes the installation of the steam boiler with the capacity of up to 150 t of steam per hour and the installation of the turbogenerator with the capacity of 35 MW. In compliance with the project scenario, the redundant blast-furnace gas, which was earlier flared due to the absence of the blast-furnace gas consumers, will be supplied to the CHPP to generate the electric power. A new steam boiler and turbogenerator commissioning will permit the effective utilization of about 250 mln. m^3 of the blast-furnace gas a year additionally to the situation befor project implementation. The electric power production at the own CHPP because of the additional utilization of the blast-furnace gas will allow to reduce the electric power supply from the power grid. The total volume of the electric power production at own CHPP in the project scenario will amount to 200,000 MWh per year.

Subproject –the waste heat utilization

To effectively use the waste heat the JSC “Zaporizhstal” has provided the reconstruction of the heat networks to supply the hot water to the consumers. The hot water is produced during the warm time of a year (from April to October) by the HU with the waste heat from the ECS and the WHB of the blast-furnaces and the open-hearth furnaces being used and then supplied to the consumers of the city of Zaporizhia. The seasonal supply of the heat power by the JSC “Zaporizhstal” to the consumers of the city of Zaporizhia will range from 70,000 to 120,000 Gcal per season (from April to October). The JSC “Zaporizhstal” heat power supply to the consumers will permit to reduce the production of the heat power in the equivalent quantity at the boiler plants of the city working on the natural gas.

History of the project

Subproject – blast-furnace gas utilization

The decision to implement the project on the construction of the turbogenerator with the capacity of 35 MW to utilize the blast-furnace gas was taken in 2004. The project documentation was elaborated in 2004-2005 (Technical and economic assessment, state agency “Ukrgipromez” (DT 336456)). The business plan of the project on the installation of the turbogenerator in the CHPP of the JSC “Zaporizhstal” was elaborated by the state agency “Ukrgipromez” in 2007 (DT 348508). The construction was taking place from 2005 to 2007. The commissioning took place in 2008.

Subproject – the waste heat utilization

The decision on starting the implementation of the project was taken in 2003. The elaboration of the project documentation was done in 2003. (The working project “Reconstruction of the heat networks from the heat and steam-air station to the thermal camera ТК П9”, state agency “Giproprom”, 2003. (DT 340020). The construction was taking place from 2004 to 2005. The city of Zaporizhia began to receive the heat power from JSC “Zaporizhstal” in 2005.

Baseline scenario

Subproject – blast-furnace gas utilization

The baseline scenario is reconstruction and continuation of turbogenerator with the available capacity of 18 MW operation. In compliance with the baseline scenario the annual production of the electric power will amount up to 150,000 MWh, the remaining quantity of the electric power will be supplied by the power grid of Ukraine. The redundant blast-furnace gas will be flared.

Subproject –waste heat utilization

The baseline scenario envisages the situation without the implementation of the project on reconstruction the heat networks to supply the heat power to the consumers of the city of Zaporizhia. In compliance with the baseline scenario the waste heat at the JSC “Zaporizhstal” is not used during the warm time of a year (from April to October): the steam from the ESC is thrown into the atmosphere, WHB are taken out of service. The consumers of the city of Zaporizhia are supplied the hot water by the city boiler plants working on the natural gas.

Reduction of greenhouse gases emissions

The implementation of the project scenario will bring to the greenhouse gases (GHG) emissions reduction, which will be achieved by the followig: the fossil fuel to produce the electric power in the power grid of Ukraine and the heat power in the boiler plants of the city of Zaporizhia will not be combusted. The GHG emissions reduction as a result of the implementation of the project on the effective utilization of the blast-furnace gas and the waste heat at the JSC "Zaporizhstal" will amount to 366,381 tCO_2 equivalent for the period 2008 to 2012, including the reduction due to the utilization of the blast-furnace gas which will amount to 270,895 tCO_2 equivalent, and the reduction due to the effective utilization of the waste heat amounting to 95,486 tCO_2 equivalent.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host Party)	JSC "Zaporizhstal"	No

A.4. Technical description of the project:

A.4.1. Location of the project:

The project is located on the territory of the JSC "Zaporizhstal", city of Zaporizhzhya, Zaporizhzhya region, Ukraine.

A.4.1.1. Host Party(ies):

Ukraine

A.4.1.2. Region/State/Province etc.:

Zaporizhskaya oblast (region)

A.4.1.3. City/Town/Community etc.:

Zaporizhia

A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):

The project is being implemented within the integrated iron-and-steel works of the JSC "Zaporizhstal" located in the city of Zaporizhzhya, Zaporizhzhya region, Ukraine. The site co-ordinates are: 47°52' N, 35°09' E.

Ukraine is situated in the south-eastern part of Central Europe. It occupies an area of 603 000 sq. km. Ukraine stretches for 1316 km from the west to the south and for 893 km from the north to the south. In the south Ukraine is washed by the Black Sea and the Sea of Azov. In the north Ukraine borders Belarus, in the east and north-west Russia, in the south-west Hungary, Romania and Moldova and Poland and in the west Slovakia. Ukraine comprises 24 administrative districts.

Zaporizhzhya region: it is situated in the south-east of Ukraine. The area of the Zaporizhzhya region is 27,200 sq. km (4.5% of the area of Ukraine). Population – 2,023,800 people (4% of the population of

Ukraine). The Zaporizhzhya region borders Dnipropetrvsk, Kherson and Donetsk regions and in the south-east its coast is washed by the waters of the Sea of Azov.

The Zaporizhzhya region is one of the most developed industrial regions of Ukraine. Over 90% of total industrial production is in heavy industry, the electric power industry and machine-construction. Over 160 large manufacturing corporations operate in the region.

The city of Zaporizhzhya is the administrative capital of the Zaporizhzhya region situated on the Dnieper river. The population of the city of Zaporizhzhya is about 855,500 people (2007).

Figure. A.4.1-1. Ukraine, Zaporizhia

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

Subproject – blast-furnace gas utilization

To utilize the redundant blast-furnace gas at the CHPP of the JSC "Zaporizhstal" the project scenario envisages the installation of the steam boiler E-120/150-3,2-390 DKGM with the capacity up to 150 t of steam per hour, cogeneration steam turbine ST-35-2,9/0,8/0,12 with two adjustable steam extractions, with the nominal capacity of 35 MW with the rotating frequency of 50 s^{-1} (3,000 rot/min) which is designed to directly drive the alternating-current generator of the type TA-35-2MU3.

The main specifications of the equipment envisaged by the project scenario are given below in the tables A.4.2-1. - A.4.2-3. Technological scheme of electric power production at the JSC "Zaporizhstal" is given in the Annex 4. The project's equipment (steam boiler, steam turbine and generator) conforms to the modern level of energy equipment (the technical specification is provided below). The technological scheme based on effective and full waste gas (blast-furnace gas) utilization is new for JSC "Zaporizhstal" and not commonly used in Ukrainian metallurgical works. The common practice is partly blast-furnace gas utilization[2] as the the blast-furnace gas has a net calorific value considerably less

[2] Confirmed based on: historical data of blast-furnace gas utilization (Annex 2 of the PDD); investment unattractiveness of the projects for blast-furnace gas utilization (section B of the PDD); relevant sectoral studies (http://www.metaldaily.ru/news/news36236.html)

than other gaseous fuels as natural gas and coke-oven gas[3].

Table A.4.2-1. The main specifications of the steam boiler

№	Name	Measuring unit	Value
1	Manufacturer	-	Cotloturboprom, Ltd, Harkiv
2	Model	-	Boiler E-120/150-3,2-390 DKGM
3	Steam generation	t/h	120/150
4	Efficiency factor	%	89,25
5	Steam pressure	atm	32
6	Steam temperature	°C	395
8	Furnace gases temperature	°C	162
9	Nitrogen oxides emissions in all the modes	mg/m^3	118
10	Specific consumption of the standard fuel per 1 Gcal of the steam	kg/Gcal	160,1

Table A.4.2-2. The main specifications of the steam turbine

№	Name	Measuring unit	Value
1	Manufacturer	-	JSC "Turboatom", Harkiv
2	Model	-	ST-35-2,9/0,8/0,12
3	Rotor rotating frequency	rot/min	3,000
4	Steam pressure	atm	30
5	Steam temperature	°C	390
6	Cooling water temperature	°C	42
7	Cooling water flow	m^3/h	9,227
8	Total condenser cooling surface	m^2	3,728
9	Absolute pressure of the thermal takeoff	kgs/cm^2	1,20

[3] IPCC Guidelines for National Greenhouse Gas Inventories, 2006 – Volume 2: Energy, Chapter 1: Introduction, Table 1.2, p. 1.18

10	Nominal turbine capacity	MW	35
11	Steam consumption in the condensation mode	t/h	160
12	Maximum steam consumption	t/h	250

Table A.4.2-3. The main specifications of the generator

№	Name	Measuring unit	Value
1	Manufacturer	-	JSC "Electrotyagmash", Harkiv
2	Model	-	TA-35-2MU3
3	Capacity at the generator terminals	MW	35
4	Generator efficiency factor in the condensation mode	%	97,4
5	Specific consumption of the steam in the condensation mode	kg/кWh	4,51
6	Specific consumption of the heat in the condensation mode	kcal/кWh	3,207

Subpoject – waste heat utilization

To utilize the waste heat it is planned to reconstruct the heat networks to supply the heat power to the consumers.

The reconstruction of the heat networks consists of:

- dismantling of the existing pipeline 2Du700;
- setting up the unit to cut in the heat networks of the works;
- construction of two new in-plant piped routes of the heating pipeline (2Du600) 1,4 km long from the unit of cutting in the heat networks of the works to the thermal camera TC P9;
- heat-insulation of the pipeline with the polyurethane polycylinders covered with the galvanized steel;
- setting up the unit to cut in the heat networks of the camera TC P9;
- setting up the unit of the commercial record of the supplied heat power.

The project’s technology (waste heat utilization in metallurgical works for heat power production and supply that to the consumers – districts of Zaporizhia) is only one of its kind. The districts of Zaporizhia that are not supplied with heat from Zaporizhstal are supplied with heat from the city boiler plants only. For the last 5 years no project on supplying the consumers of the city of Zaporizhia with the hot water by the other industrial enterprises (except the JSC “Zaporizhstal”) using waste heat, waste technological gases or the alternative sources of energy was implemented.

To produce the hot water to further supply it to the consumers is used the existing infrastructure of the works: the steam from the ECS of the blast-furnaces and open-hearth furnaces and from the WHB of the open-hearth furnaces is fed to the HU where the water is heated. The hot water is supplied to the consumers by means of the heat networks, which are planned to be reconstructed in compliance with the project.

The thechnological scheme of the production and supply of the heat power at the JSC "Zaporizhstal" to the consumers of the city of Zaporizhia is given in the Annex 4.

The implementation schedule of the project is presented below in the diagram A.4.2-1.

Diagram A.4.2-1. Implementation schedule of the project

№	Subproject / Work's stage	2003	2004	2005	2006	2007	2008
1	Waste heat utilization						
1.1	Development of project documentation						
1.2	Construction and installation works						
1.3	Pre-commissioning works						
2	Blast-furnace gas utilization						
2.1	Development of project documentation						
2.2	Construction and installation works						
2.3	Pre-commissioning works						

The regular training of CHPP's staff in JSC "Zaporizhstal" is provided because of new equipment installation and their operation.[4]

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

The GHG emissions reduction as a result of implementation of the project scenario is achieved by prevention of combustion of the fossil fuel to produce the electric power and the heat.

The installation of the new turbogenerator at the CHPP of the JSC "Zaporizhstal" will bring to increasing the production of the electric power due to the blast-furnace gas utilization which is flared in the absence of the proposed project. Increasing the production of the electric power at the CHPP of the JSC "Zaporizhstal" with the use of the blast-furnace gas will permit to reduce the supply of the electric power from the power grid of Ukraine in the equivalent quantity and thus to reduce the GHG emissions related to the combustion of the fossil fuel.

To produce the heat power with the further its supply to the consumers of the city of Zaporizhia, the JSC "Zaporizhstal" uses the waste heat only (steam of the ECS and the WHB of the blast-furnaces and the open-hearth furnaces), without using the fossil fuel. Production of the replaceable heat power in the

[4] The additional information for CHPP's staff training is attached to the PDD.

boiler plants uses the natural gas. Thus, the project implementation allows reducing the consumption of the natural gas to produce the heat power in the boiler plants and reducing the emissions related to this.

The GHG emissions reduction as a result of the implementing the project on the effective utilization of the blast-furnace gas and the waste heat at the JSC "Zaporizhstal" will amount to 366,381 tCO_2 equivalent for the period 2008 to 2012, including the reduction due to the utilization of the blast-furnace gas which will amount to 270,895 tCO_2 equivalent, and the reduction due to the effective utilization of the waste heat amounting to 95,486 tCO_2 equivalent.

The detailed description of the CO_2 emissions in the baseline and the project scenario is given in Sections B and E of the PDD.

The current legislation of Ukraine does not restrict activities causing GHG emissions in the field of control of anthropogenic GHG emissions. Thus, the project may develop in any of the possible scenarios. In case there is no possibility to attract the additional investments to implement the project with the help of the mechanisms of the Kyoto protocol, the project would develop in compliance with the baseline scenario (the choise and justification of the baseline scenario are provided in section B.1. and B.2.). The Baseline scenario does not contradict the national and the branch policy in the field of the GHG emissions regulations and could be implemented in the absence of the proposed project but that would not allow reducing the GHG emissions.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

Table A.4.3-1. Estimated amount of emission reductions during the first commitment period

	Years
Length of the crediting period	5 years (60 months)
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent.
2008	53,618
2009	51,751
2010	61,204
2011	99,904
2012	99,904
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	366,381
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	73,276

Table A.4.3-2. Estimated amount of emission reductions before the first commitment period

	Years
Length of the crediting period	3 years (31 months)
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent.
2005	13,318
2006	15,652
2007	17,298
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	46,268
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	15,423

Table A.4.3-3. Estimated amount of emission reductions after the first commitment period

	Years
Length of the crediting period	8 years (96 months)
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent.
2013	99,904
2014	99,904
2015	99,904
2016	99,904
2017	99,904
2018	99,904
2019	99,904
2020	99,904

Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	799,232
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	99,904

A.5. Project approval by the Parties involved:

The proposed project obtained the Letter of Endorsement of the Ministry for Environmental Protection of Ukraine, which proves the possibility of the implementation of this project as the JI project. *The copy of the Letter of Endorsement may be provided on request.*

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

Description and justification of the baseline chosen is provided in accordance with "Guidance on criteria for baseline setting and monitoring", (Version 02).[5]

The **JI specific approach**[6] is used for description and justification of the baseline chosen that includes the following steps:

1. Indication and description of the approach chosen regarding baseline setting
2. Application of the approach chosen

Step 1. Indication and description of the approach chosen regarding baseline setting

The JI specific approach for baseline setting includes **the following steps**:

1) Identifying plausible alternative scenarios to the project.

At this stage the possible alternative scenarios are defined and checked if they are in line with the current legislation and if they are available to the project participants.

2) Analysis of the key factors that affect the implementation of the alternative scenarios:

2.1) Financial barrier (economic efficiency).

This stage consists of the analysis of the investment attractiveness of the alternative scenarios. The investment analysis draws a conclusion on the economic expediency of the alternative scenarios implementation.

3) Choise of the most plausible scenario

This stage results in defining of the baseline. The baseline scenario is the economically reasonable and economically most attractive alternative.

Step 2. Application of the approach chosen

1. Identifying plausible alternative scenarios to the project

The list of the alternative scenarios is formed considering the following terms:

- All alternative scenarios should be available to the project participants;
- All alternative scenarios should ensure the output of the products in the comparable quantity and having the comparable quality and properties.

To identify the alternative scenarios the following quantity indicators is used:

Subproject – blast-furnace utilization

Supply with electric power the JSC "Zaporizhstal" in line with the project scenario amounts to ca 200 000 MWh per year. The available capacity on the electric power production in the CHPP of the JSC "Zaporizhstal" should be no less than the electric load of the reserved consumers (about 17 MW).

Subproject – waste heat utilization

[5] Source: http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[6] In accordance with paragraph 9(a) "Guidance on criteria for baseline setting and monitoring", (Version 02). The approved CDM methodologies are not used for choice, justification and setting of the baseline.

Heat power supply to the city of Zaporizhia in the warm period of a year amounts to ca 70,000 – 120,000 Gcal per year.

The description of plausible alternative scenarios and analysis of their correspondence with the technical regulation and implementation availability are given in Annex 2.

The list of alternative scenarios corresponding to the current legislation and available to the project participants:

Subproject – blast-furnace gas utilization

Alternative scenario 1. Installation of the steam boiler with the capacity of up to 150 t steam per hour and the turbogenerator with the capacity of 35 MW. Operation of the turbogenerator with the available capacity 18 MW without reconstruction. The redundant blast-furnace gas is utilized to produce the electric power.

Alternative scenario 2. The reconstruction and the further operation of the turbogenerator with the available capacity 18 MW without steam boiler replacement and flaring of the redundant blast-furnace gas.

Subproject – waste heat utilization

Alternative scenario 1. Production the hot water in the heating unit using the waste steam of the ECS and the WHB of the blast furnaces and the open-hearth furnaces of the JSC "Zaporizhstal". Reconstruction of the heat networks to supply the heat to the consumers.

Alternative scenario 2. The waste heat at the JSC "Zaporizhstal" during the warm time of the year is not used: the steam of the ECS is thrown into the atmospheres, the WHB are taken out of service. The consumers of the city of Zaporizhia are supplied with the hot water by the city boiler plants working on the natural gas.

2. Analysis of the key factors that affect the implementation of the alternative scenarios

The key factors are directly or indirectly factors to the alternative scenarios that affect their implementation.

The list of the key factors that affect the implementation of the alternative scenarios:

1) Financial barrier (economic efficiency).

Definition of key factors

Financial barrier (economic efficiency).

The presence of a financial barrier for a specific scenario means that economic parameters of the scenario are not acceptable for the project participants.

The presence of the above barriers for implementation of alternative scenarios means that they may not be implemented if there is a more profitable alternative or there is no possibility of overcoming them.

Analysis of the key factors that affect the implementation of the alternative scenarios

Financial barrier (economic efficiency).

In order to assess the impact of the financial barrier it is necessary to review the economical efficiency of the investment budget of the presented alternative scenarios.

Subproject – blast-furnace gas utilization

The most relevant financial index for the investment analysis of the alternative scenarios of the project on the blast-furnace gas utilization is the levelised cost of electricity. The results of the investment comparison analysis[7] are given in table B.1-1.

The analysis of the economic efficiency is made for the alternative scenarios corresponding to the technical regulation and available for the project participants:

Alternative scenario 1. Installation of the steam boiler with the capacity of up to 150 t steam per hour and the turbogenerator with the capacity of 35 MW. Operation of the turbogenerator with the available capacity 18 MW without reconstruction. The redundant blast-furnace gas is utilized to produce the electric power.

Alternative scenario 2. The reconstruction and the further operation of the turbogenerator with the available capacity 18 MW without steam boiler replacement and flaring of the redundant blast-furnace gas.

Table B.1-1. Specific cost of the consumed electric power

№	Parameter	Alternative scenario 1	Alternative scenario 2
1.	Investment, th. €	16,288.9	2,014.3
2.	Operational costs, th. € / year	3,384.4	3,634.5
3.	Electricity consumtion, MWh / year	200,000.0	200,000.0
4.	Levelised electricity cost, € / MWh	28.4	21.0

Therefore the alternative scenario 2 is more attractive regarding the financial index than the alternative scenario 1: the levelised electricity cost in the alternative scenario 2 (21.0 € / MWh) is less at 26.1%, than in the alternative scenario 1 (28.4 € / MWh).

The results of the sensitivity analysis[8] confirmed the conclusions of the investment comparison analysis are provided in tables B.1-2. and B.1-3.

Table B.1-2. The sensitivity analysis for investment cost

№	Parameter	Alternative scenario 1		Alternative scenario 2	
1.	Change of Investment	- 10%	+ 10%	- 10%	+ 10%
2.	Investment, th. €	14,660.0	17,917.7	1,812.9	2,215.7
3.	Operational costs, th. € / year	3,384.4	3,384.4	3,634.5	3,634.5

[7] The levelised cost of electricity calculation is attached in excel file.

[8] The sensitivity analysis is attached in excel file.

4.	Electricity consumtion, MWh / year	200,000.0	200,000.0	200,000.0	200,000.0
5.	Levelised electricity cost, € / MWh	27.5	29.3	20.9	21.2

Table B.1-3. The sensitivity analysis for operational costs

№	Parameter	Alternative scenario 1		Alternative scenario 2	
1.	Change of Operational costs	- 10%	+ 10%	- 10%	+ 10%
2.	Investment, th. €	16,288.9	16,288.9	2,014.3	2,014.3
3.	Operational costs, th. € / year	3,045.9	3,722.8	3,271.0	3,997.9
4.	Electricity consumtion, MWh / year	200,000.0	200,000.0	200,000.0	200,000.0
5.	Levelised electricity cost, € / MWh	26.5	30.3	19.1	23.0

Performed sensitivity analysis shows that the change of the investment and operational cost in range of ±10% hasn't influence on the financial attractiveness of alternative scenarios.

Subproject – waste heat utilization

In this subproject the analysis of the economic efficiency of the investment costs is made for the alternative scenario 1 only, as the alternative scenario 2 is the continuation of the current situation and does not require the additional investments and therefore the financial barrier has no impact on it:

> **Alternative scenario 1.** Production the hot water in the heating unit using the waste steam of the ECS and the WHB of the blast furnaces and the open-hearth furnaces of the JSC "Zaporizhstal". Reconstruction of the heat networks to supply the heat to the consumers.

Given below (in the table B.1-4.) are the results of the economic efficiency analysis for the alternative scenario 1 of the subproject – waste heat utilization.[9]

Table B.1-4. Results of the economic efficiency analysis of the alternative scenario 1 of the subproject – waste heat utilization

№	Index	Data
1.	Investment, th. €	854.43

[9] The investment analysis is attached in excel file.

2.	Proceeds from a sale of the heat power, th. € / year	510.00
3.	Operational costs, th. € / year	430.0
4.	Discount rate, %	9.12%
5.	Net present value, th. €	- 170.0
6.	Discount payback period, years	NA

Table B.1-4. shows that the alternative scenario 1 of the subproject "Waste heat utilization" is not commercially attractive alternative without an co-benefit and that proves the presence of the financial barrier.

The conclusion based on the investment analysis can be confirmed with the sensitivity analysis. The key information of the sensitivity analysis[10] is presented in the table B.1-5.

Table B.1-5. The sensitivity analysis for the subproject "Waste heat utilization"

№	Index	Change of Investment		Change of Operational costs	
		- 10%	+ 10%	- 10%	+ 10%
1.	Investment, th. €	769.0	939.9	854.43	854.43
2.	Proceeds from a sale of the heat power, th. € / year	510.00	510.00	510.00	510.00
3.	Operational costs, th. € / year	430.0	430.0	- 396.1	463.9
4.	Discount rate, %	9.12%	9.12%	9.12%	9.12%
5.	Net present value, th. €	- 100.3	- 239.7	- 36.4	- 303.6
6.	Discount payback period, years	NA	NA	NA	NA

3. Choice of the most plausible scenario – baseline

The results of the performed analysis of key factors affected the alternative scenarios make it possible to draw the conclusion that the most plausible scenarios are as follows:

Subproject – blast-furnace gas utilization

[10] The sensitivity analysis is attached in excel file.

Alternative scenario 2. The reconstruction and the further operation of the turbogenerator with the available capacity 18 MW without steam boiler replacement and flaring of the redundant blast-furnace gas.

Subproject –waste heat utilization

Alternative scenario 2. The waste heat at the JSC "Zaporizhstal" during the warm time of the year is not used: the steam of the ECS is thrown into the atmospheres, the WHB are taken out of service. The consumers of the city of Zaporizhia are supplied with the hot water by the city boiler plants working on the natural gas.

The alternative scenarios mentioned above are the **baseline.**

The following parameters are used **to establish the baseline** (estimation of greenhouse gas emissions according to the baseline):

- Electric power production at own CHPP in the baseline scenario
- Electric power supply by the power grid in the baseline scenario
- Heat power production supplied to the consumers of the city of Zaporizhia
- CO_2 emission factor during electric power generation supplied by the power system of Ukraine for the projects consuming electric power
- Maximal electric load of the turbogenerator according to the baseline scenario
- Conversion factor of Gcal into TJ
- CO_2 emission factor from electric power generation in own CHPP
- CO_2 emission factor by heat power production which would be produced in the absence of the project activity

Data / parameter	$P_{ELEC,own,BL,y}$
Data unit	MWh
Description	Electric power generation in own CHPP in the baseline scenario
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Estimated based on actual data for 2008
Value of data (for ex ante calculations/determinations)	2008: 150,000; 2009: 150,000; 2010: 150,000; 2011: 150,000; 2012: 150,000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Estimation is completed based on actual data of electricity generation in the CHPP of JSC "Zaporizhstal" in year 2008 in accordance with formulae 2.1.1-2.1.5 of the section D of the PDD. Assumed that the electricity generation in the following years will be on the same level as the electricity generation in the baseline scenario in amount 150 000 MWh corresponds with electrical

	load 95% and it can not be likely increase.
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	$EC_{grid,BL,y}$
Data unit	MWh
Description	Electric power supply by the power grid in the baseline scenario
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Estimated
Value of data (for ex ante calculations/determinations)	2008: 50 000; 2009: 50 000; 2010: 50 000; 2011: 100 000; 2012: 100 000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Electric power supply by the power grid in the baseline scenario is estimated in accordance with formula 2.2.1 of the section D of the PDD. Electric power generation in the baseline scenario is 150,000 MWh/year. Electric power generation in the project scenario is 200,000 MWh/year for 2008-2010 (determined based on actual data for 2008) and 250,000 MWh/year for 2011-2012 (forecast of JSC “Zaporizhstal”).
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	$P_{HEAT,PJ,y}$
Data unit	Gcal
Description	Heat power production supplied to consumers of the city of Zaporizhia in the project scenario
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Actual data and forecast of JSC “Zaporizhstal”
Value of data (for ex ante calculations/determinations)	2008: 65,646; 2009: 58,300; 2010: 100,000; 2011: 100,000; 2012: 100,000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The amount of heat power supplied to the consumers of the city of Zaporizhia in the project scenario is determined dased on measurement data for years 2008-2009 and on forecast of heat power

	supply for consumers.
QA/QC procedures (to be) applied	Measuring devices are calibrated/verified in compliance with the state regulation, in-plant standards and approved methodologies for measuring devices calibration/verification.
Any comment	-

Data / parameter	**$EF_{CO2,ELEC,grid,y}$**
Data unit	tCO_2/MWh
Description	CO_2 emission factor during the electric power generation supplied by the power grid of Ukraine for the projects consuming electric power
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Global Carbon B. V.: “Ukraine - Assessment of new calculation of CEF”
Value of data (for ex ante calculations/determinations)	0.896
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$ED_{BL,max}$**
Data unit	MW
Description	Maximal electrical load of the turbogenerator in the baseline scenario
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Estimated based on actual data
Value of data (for ex ante calculations/determinations)	18
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Maximal electrical load of the turbogenerator in the baseline scenario is determined based on analysis of daily electrical load of the turbogenerator in period of three last years operation (2005-2007).

	The provided analysis makes it clear that the average maximal electrical load of the turbogenerator was 15.6 – 15.9 MW and was not more than 17.7 MW. For calculation of the baseline emissions is to use the value of maximal electric load (18 MW) that ensures the conservative assumption of GHG emissions reduction calculation.
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	$\mathbf{K_{TJ/Gcal}}$
Data unit	TJ/Gcal
Description	Convertion factor of Gcal into TJ
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	V. Kudrin. Theory and technology of steel production: manual for the higher educational institutions. – Moscow: Mir, 2003 - p. 503
Value of data (for ex ante calculations/determinations)	0.00418
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	$EF_{CO2,ELEC,own,y}$
Data unit	tCO_2/MWh
Description	CO_2 emission factor from electric power generation in own CHPP
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Estimated
Value of data (for ex ante calculations/determinations)	0,122
Justification of the choice of data or description of	Estimation is completed using the formulae 1.1, 1.1.1, 1.2, 2.1.6 of the section D of the PDD based

measurement methods and procedures (to be) applied	on actual data for 2008.
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$EF_{HEAT,y}$**
Data unit	tCO_2/TJ
Description	CO_2 emissions factor during the heat power production which would be produced in the absence of the project activity
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated parameter
Value of data (for ex ante calculations/determinations)	56.1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	*Formula for calculation:* $EF_{HEAT,y} = EF_{CO2,i,default} / \eta_{HG,i}$ $EF_{CO2,i,default}$ - default emission factor from natural gas combustion, tCO_2/TJ $\eta_{HG,i}$ – efficiency factor of the heat power production. *Data for calculation:* $EF_{CO2,i,default}$ = 56.1 tCO_2/TJ $\eta_{HG,i}$ = 1 (*or* 100%) *Source of data:* IPCC Guidelines of the national inventory of the greenhouse gases, 2006 – volume 2 Power, Chapter 1, Introduction, table 1.4, page 1.26 Efficiency factor of the heat power production is assessed (comment below).
QA/QC procedures (to be) applied	-
Any comment	In the absence of the project activity the heat power would be produced by the boiler plants of the city of Zaporizhia with natural gas being used. The efficiency factor of the heat power generation is taken to equal to 100% for conservative assessment.

Description of the above parameters, including information about selection of values of the specified parameters, methods for their definition, sources of data and procedures for quality control and quality assessment are provided also in section D and Annexes 2 and 3 of the PDD.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

JI specific approach is used for demonstration of additionality of the project in accordance with the paragraph 2(a) of the Annex I to the “Guidance on criteria for baseline setting and monitoring”, (Version 02).[11] The approved CDM methodologies and tools are not used for demonstration of additionality.

The demonstration that the project provides reductions in emissions by sources that are additional to any that would otherwise occur, is provided using the following step-wise approach:

1. Indication and description of the approach applied
2. Application of the approach chosen
3. Provision of additionality proofs

Step 1. Indication and description of the approach applied

A JI-specific approach is chosen for justification of additionality. JISC’ guidance on criteria for baseline setting and monitoring prescribes in this case to provide traceable and transparent information showing that the baseline was identified on the basis of conservative assumptions, that the project scenario is not part of the identified baseline scenario and that the project will lead to reductions of anthropogenic emissions by sources or enhancements of net anthropogenic removals by sinks of GHGs.

Step 2. Application of the approach chosen

The analysis outlined in the section B.1. clearly demonstrates that the baseline scenario is:

For the Subproject – blast-furnace gas utilization: The reconstruction and the further operation of the turbogenerator with the available capacity 18 MW without steam boiler replacement and flaring of the redundant blast-furnace gas.

For the Subproject –waste heat utilization: The waste heat at the JSC “Zaporizhstal” during the warm time of the year is not used: the steam of the ECS is thrown into the atmospheres, the WHB are taken out of service. The consumers of the city of Zaporizhia are supplied with the hot water by the city boiler plants working on the natural gas.

The project is not a part of the baseline scenario, which can be shown by analyzing the key factors that affect the implementation of the project scenarios. The financial barrier (economic efficiency) is considered as the key factor that affects the implementation of the project scenarios. The results of the investment analysis demonsrated that the project scenario is not part of the identified baseline scenario are provided in the table B.2-1. below.

Table B.2-1. Results of the investment analysis demonstrated that the project scenario is not part of the identified baseline scenario

№	Subproject / Index	Project scenario	Baseline scenario
1.	Subproject – blast-furnace gas utilization		

[11] Source: http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

1.1	Specific cost of the consumed electric power, € / MWh	28.4	21.0
2.	Subproject –waste heat utilization		
2.1	Net discount income, th. €	- 170.0	NA

The analysis of the alternative scenarios and the key factors affected their implementation shows that the project activity is not the baseline scenario due to the presence of the substantial financial barriers to implement them. Therefore the reduction of emissions obtained in the course of project implementation is additional to the baseline scenario.

Explanation of how registration of the Project as a JI (Joint Implementation) project will reduce the effect of the barriers that prevent the Project being implemented in the absence of the use of the JI mechanism.

The analysis of the barriers proves the presence of the substantial financial barriers for the project activity implementation. That is why the registration of the project as the JI project and the attracting the additional financing at the expense of the ERU trading will help to get over the indicated barriers and to increase the attractiveness of the project.

The ERU trading will ensure the acceptable economic index on the subproject "Waste heat utilization"[12] and sufficiently reduce the specific cost of the consumed electric power on the project "Blast-furnace gas utilization"[13].

Step 3. Provision of additionality proofs

The information to support above documentation is contained in the following documents:

- Investment analysis of the project provided in excel;
- Protocols of decision of project implementation;
- Lows of Ukraine for energy and industry development and JI projects implementation.

This documentation can be provided on request.

Explanations on how GHG emission reductions are achieved

The GHG emissions reduction as a result of implementation of the project scenario is achieved by prevention of combustion of the fossil fuel to produce the electric power and the heat.

The GHG emissions reduction will amount to 366,381 tCO_2 equivalent for the period 2008 to 2012 including the reduction due to the utilization of the blast-furnace gas which will amount to 270,895 tCO_2 equivalent, and the reduction due to the effective utilization of the waste heat amounting to 95,486 tCO_2 equivalent.

The detailed description of the CO_2 emissions in the baseline and the project scenario is given in Sections E of the PDD.

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[12] Project economic efficiency calculation with the ERU trading is attached in excel format.

[13] Calculation of the specific cost of the consumed electric power with the ERU trading is is attached in excel format.

B.3. Description of how the definition of the project boundary is applied to the project:

The project boundary covers **all facilities** where greenhouse gas emissions occur and which impact the GHG emissions as a result of the project implementation:

- Blast furnace plant
- CHPP of the JSC "Zaporizhstal"
- Flare of the blast-furnace gas
- Power grid of Ukraine
- Consumers of the electric power
- ECS and WHB of the blast furnaces and the open-hearth furnaces
- Heating unit
- Consumers of the heat power
- Boiler plants of the city of Zaporizhia

The project boundaries are presented in Annex 2 of PDD. The facilities included into the project boundaries and the description of their impact on the GHG emissions are given in the table B.3-1. The sources of the GHG emissions and the greenhouse gases included into the calculation of emissions on the Baseline and the project scenarios are presented in the table B.3-2.

Table B.3-1. Facilities included into the project boundaries and the description of their impact on the greenhouse gases emissions

№	Unit	Description
1.	Blast furnace plant	In the blast-furnace plant of the JSC "Zaporizhstal" in the process of pig iron melting the blast-furnace gas is generated. This gas is partially efficiently combusted at the CHPP of the JSC "Zaporizhstal" and the other consumers, partially is flared. The installation of a new turbogenerator at the CHPP will permit to efficiently utilize the blast-furnace gas in the large amounts.
2.	CHPP of the JSC "Zaporizhstal"	To produce the electric power at the CHPP of the JSC "Zaporizhstal" the natural gas, coke oven gas and fuel oil are used. The GHG emissions are the result of their combustion. To produce the electric power in new turbogenerator will be used the blast-furnace gas which was flared before project implementation and thus the supply of the electric power by the power grid of Ukraine will be cut.
3.	Flare of the blast-furnace gas	Blast-furnace gas generated in the blast-furnace plant of the JSC "Zaporizhstal" and not used by the works is flared, and this results in the GHG emissions. The installation of a new turbogenerator at the CHPP will permit to efficiently utilize the blast-furnace gas in the large amounts and consequently to cut the blast-furnace gas flaring.
4.	Power grid of Ukraine	The JSC "Zaporizhstal" is supplying the electric power from the power grid of Ukraine and thus the JSC "Zaporizhstal" causes the GHG emissions on the power enterprises of Ukraine, which are the result of the fossil fuel combustion for the electric power generation.
5.	Consumers of the electric power	The works facilities (manufacturing units of the JSC "Zaporizhstal") consume the electric power from the CHPP of the JSC "Zaporizhstal" and

		the electric power from the power grid of Ukraine. Therefore the consumers of the electric power cause the GHG emissions at the CHPP of the JSC "Zaporizhstal" and at the power enterprises of Ukraine.
6.	ECS and WHB of the blast furnaces and the open-hearth furnaces	ECS and WHB of the blast furnaces and the open-hearth furnaces generate the steam which is used to heat the water in the heating unit. In case there are no consumers of the heat power from heating unit, the steam of the ECS is thrown into the atmosphere and the WHB are taken out of service.
7.	Heating unit	Heating unit is used to heat the water using the steam of the evaporating cooling system and waste-heat boilers of the blast furnaces and the Martin furnaces. Hot water is supplied to the consumers.
8.	Consumers of the heat power	Consumers of the heat power (hot water) are the entities of the city of Zaporizhia. Heat power is supplied to the consumers either from the heating unit of the JSC "Zaporizhstal" or from the city boiler plants. The consumers of the heat power cause the operation of the heating unit at JSC "Zaporizhstal" and the boiler plants and emissions related to this.
9.	Boiler plants	The city boiler plants generate the heat power (hot water). To generate the heat power the boiler plants of the city of Zaporizhia use the natural gas.

Table B. 3-2. Sources of GHG emissions included/excluded from the project boundaries

Baseline scenario				
1	Power grid of Ukraine	CO_2	Included	Emissions during fossil fuel combustion for electric power generation.
		CH_4	Excluded[14]	Excluded for simplification. Conservative approach.
		N_2O	Excluded[15]	Excluded for simplification. Conservative approach.
2	CHPP of the JSC "Zaporizhstal"	CO_2	Included	Emissions during fuel (natural gas, coke oven gas, fuel oil) combustion to generate electric power. Blast-furnace gas combustion is not taken into account as the total volume of the blast-furnace gas combustion including the efficient combustion and the flaring is the same for the project and baseline scenario.
		CH_4	Excluded	Excluded for simplification. Conservative approach.
		N_2O	Excluded	Excluded for simplification. Conservative approach.

[14] See comments in Table B.3-3

[15] See comments in Table B.3-3

3	Flare of the blast-furnace gas	CO_2	Excluded	Emissions from the blast-furnace gas flaring are not taken into account as the total volume of the blast-furnace gas combustion including the efficient combustion and the flaring is the same for the project and baseline scenario.
		CH_4	Excluded	Excluded for simplification. Conservative approach.
		N_2O	Excluded	Excluded for simplification. Conservative approach.
4	Boiler plants	CO_2	Included	Emissions during the fossil fuel combustion for heat power generation.
		CH_4	Excluded	Excluded for simplification. Conservative approach.
		N_2O	Excluded	Excluded for simplification. Conservative approach.
Project scenario				
1	Power grid of Ukraine	CO_2	Included	Emissions during fossil fuel combustion for electric power generation.
		CH_4	Excluded	Excluded for simplification. Conservative approach.
		N_2O	Excluded	Excluded for simplification. Conservative approach.
2	CHPP of the JSC “Zaporizhstal”	CO_2	Included	Emissions during fuel (natural gas, coke oven gas, fuel oil) combustion to generate electric power. Blast-furnace gas combustion is not taken into account as the total volume of the blast-furnace gas combustion including the efficient combustion and the flaring is the same for the project and baseline scenario.
		CH_4	Excluded	Excluded for simplification. Conservative approach.
		N_2O	Excluded	Excluded for simplification. Conservative approach.

The sources of the GHG emissions indicated in table . B.3-1. are defined in the line with the “Guidance on criteria for baseline setting and monitoring”, (Version 02) and provided in the table B.3-3.

Table B.3-3. Criteria to define the project boundaries

№	Criterion to define the project boundaries	Comments
1.	*Under the control of the project participant*	The sources of GHG emissions (CHPP) are under the control of the JSC "Zaporizhstal" as they are the property of the Company and are directly operated by the Company. The sources of the emissions (power system, boiler plants) are under the control (impact) of the JSC "Zaporizhstal" as the GHG emissions by this sources occur or are prevented in the result of the JSC "Zaporizhstal" activity, i.e. at increasing/decreasing the electric power generation at the works CHPP and the heat power generation at the heating unit.
2.	*Reasonably attributable to the project*	The sources of the GHG emissions defined in table B.3-1. are directly connected to the project facilities of the JSC "Zaporizhstal" by the power and material flows and that is why the implementation of the project activity impacts greatly the deviation of the GHG emissions by these sources. Due to this all the defined sources are reasonably attributable to the project.
3.	*Significant, i.e., as a rule of thumb, would by each source account on average per year over the crediting period for more than 1 per cent of the annual average anthropogenic emissions by sources of GHGs, or exceed an amount of 2,000 tonnes of CO_2 equivalent, whichever is lower.*	Emissions by the considered sources are significant, they total to more than 1 % or exceed an amount of 2,000 t of CO_2 equivalent (see section E.) CH_4 and N_2O emisssions are not considered in the project boundaries as their total emissions are not significant in the project and baseline scenarios.

The project does not provide to the leakage.

In accordance with "Guidance on criteria for baseline setting and monitoring", (Version 02) the leakage is determined as "the net change of anthropogenic emissions by sources and/or removals by sinks of GHGs which occurs outside the project boundary, and that can be measured and is directly attributable to the JI project."

The main emissions potentially giving rise to leakage in the context of the project are emissions arising from fossil fuel use (e.g. extraction, processing, transport) for electricity production in the grid and heat production in the heat boilers.

In case the potential leakage is determined the project participants must undertake an assessment of the potential leakage of the proposed JI project and explain which sources of leakage are to be calculated, and which can be neglected.[16]

Because of the project provides to reduction of electricity generation in the grid and reduction of heat power production in the heat boilers of the city of Zaporizhia (see the section A.4.3.) the project implementation brings to the reduction of fossil fuels consumption and accordingly to reduction of the leakage arising from fossil fuel use (e.g. extraction, processing, transport). Therefore, the leakage is negligible and can be not taken into account with relation to the conservative estimation of emission reductions.

[16] In accordance with the paragraph 18 of the Guidance on criteria for baseline setting and monitoring, (Version 02).

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

Date of baseline setting: 01/03/2010

The baseline has been developed by:

CJSC "National Carbon Sequestration Foundation" (Moscow);

Contact person: Mr. Roman Kazakov, principal specialist;

Tel.: +7 499 788 78 35 ext. 113

Fax: +7 499 975 78 35 ext. 107

E-mail: KazakovRA@ncsf.ru

CJSC "National Carbon Sequestration Foundation" is not a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

02/06/2004

C.2. Expected operational lifetime of the project:

20 years (240 months)

C.3. Length of the crediting period:

Length of the crediting period is 02/06/2005 – 31/12/2020 (16 years, 187 months), including:

- Period before the first commitment period: 02/06/2005 – 31/12/2007 (3 years, 31 months);
- First commitment period: 01/01/2008 – 31/12/2012 (5 years, 60 months);
- Period after the first commitment period: 01/01/2013 – 31/12/2020 (8 years, 96 months).

Section D. Monitoring plan

D.1. Description of the monitoring plan chosen:

Monitoring plan of the GHG emissions in the project and baseline scenarios and the GHG emissions reduction is elaborated on the basis of requirements of the "Guidance on criteria for baseline setting and monitoring", (Version 02).[17]

The monitoring plan employs the following approaches to the determination of the GHG emissions in the project and baseline scenarios:

1. The calculation of CO_2 emissions during the fuel combustion to generate the elecrtic power at the CHPP of the JSC "Zaporizhstal" is made on the basis of the following data:

- Fuel consumption according to the type of the fuel;
- CO_2 emissions factor for each type of the fuel used.

While calculating the CO_2 emissions during the electric power generation in the CHPP the blast-furnace gas combustion is not taken into account as the total volume of the produced blast-furnace gas does not depend on the CHPP operation (i.e. does not depend on the project and baseline scenarios) and all the blast-furnace gas is combusted by the consumers or flared.

2. The calculation of the CO_2 emissions by electric power generation in the power grid is made on the basis of the following data:

- Electric power consumption from the power grid of Ukraine;
- CO_2 emission factor during electric power generation supplied by the power grid of Ukraine.

3. The calculation of the CO_2 emissions in the result of the heat power production is made on the basis of the following data:

- Heat power generation;
- CO_2 emission factor during the heat power production which would be produced in the absence of the project activity

The parameters necessary to make calculation in line with the above mentioned approaches include:

1. Parameters which are continuously monitored during the crediting period:

- Fuel consumption for elecric power generation in CHPP
- Chemical composition of natural gas

[17] Source: http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

- Electric power generation in CHPP
- Heat power generation supplied to consumers of the city of Zaporizhia
- Elecric power consumption to supply heat power to consumers of the city of Zaporizhia

These parameters including the information on their recording and archiving are given in tables D.1.1.1 and D.1.1.3. The principle scheme of the monitoring points' location is given below at the figure D.1-1.

2. Parameters which are determined once and are taken as constants for the whole monitoring period. They are available at the stage of determination:

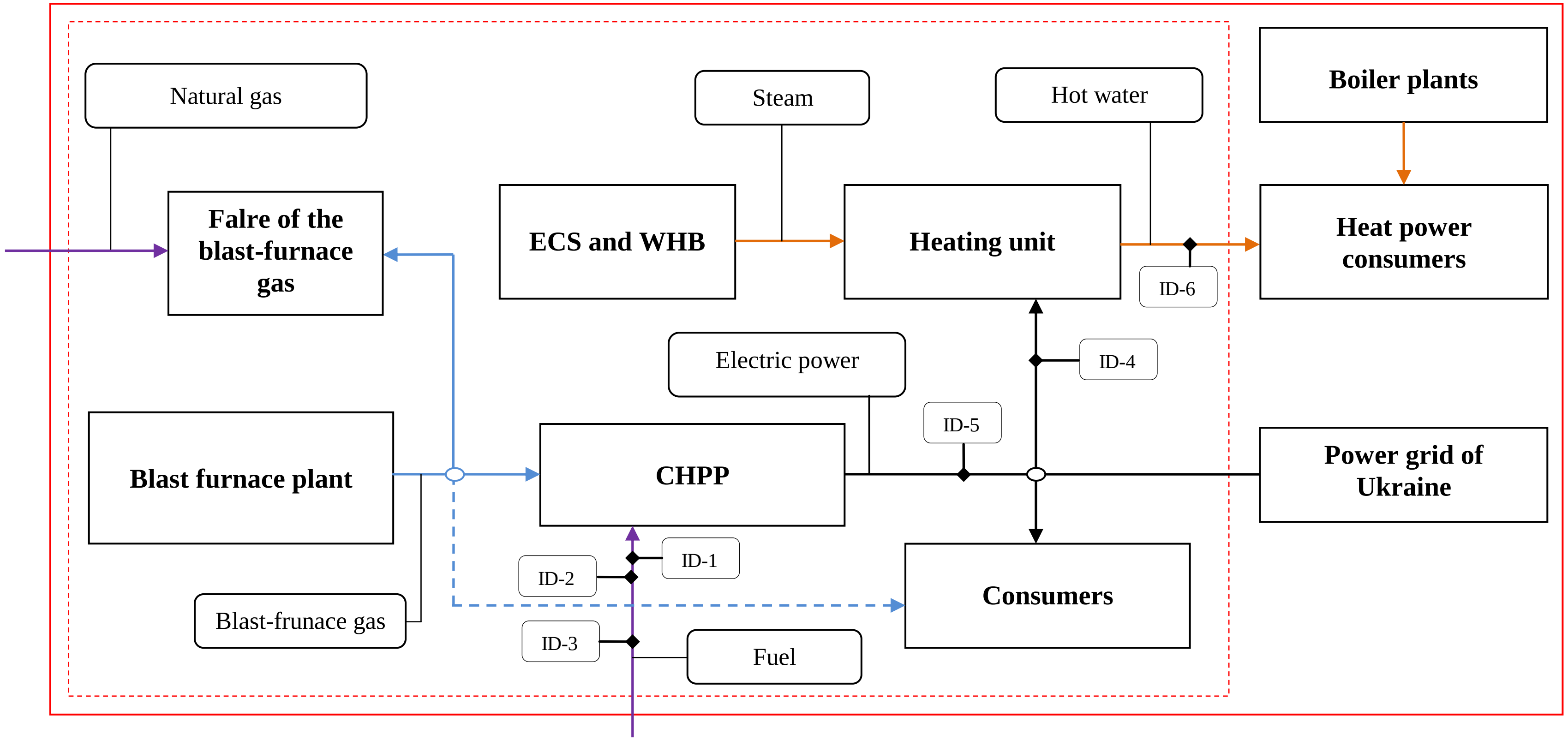
- CO_2 emission factor from fuel oil combustion
- CO_2 emission factor from coke oven gas combustion
- CO_2 density under the normal conditions
- Number of the carbon moles per mole of the gaseous fuel component
- CO_2 emission factor during electric power generation supplied by the power grid of Ukraine
- Maximal electrical load of the turbogenerator in the baseline scenario
- Conversion factor of natural fuel into standard fuel
- Conversion factor of Gcal into TJ
- CO_2 emission factor during the heat power production which would be produced in the absence of the project activity

The above parameters detailed information is provided in Annex 3 “Monitoring plan”.

3. Parameters which are determined once and are taken as constants during monitoring but are not available at the stage of determination:

Absent.

Figure D.1-1. Principle scheme of the project monitoring points' location



D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
Please use numbers to ease cross-referencing to D.2.)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
ID-1 $FC_{ELEC,own,PJ,y}$	Fuel consumption for electric power generation in CHPP in the project scenario	Technical report for CHPP operation	t of standard fuel	c	monthly	100 %	Electronic and paper	Scheme of data collection, delivery and processing and responsible persons is provided in the Annex 3 of the PDD
ID-2 $W_{i,ELEC,own,PJ,y}$	Fuel i fraction in total fuel consumption for electric power generation in CHPP in the project scenario	Technical report for CHPP operation	fraction (t of standard fuel/t of standard fuel)	c	monthly	100 %	Electronic and paper	Scheme of data collection, delivery and processing and responsible persons is provided in the Annex 3 of the PDD
ID-3 $W_{j,y}$	Volume fraction of j-components of gaseous fuel	Certificate of physical and chemical parameters of gaseous fuel	fraction	m	monthly	100 %	Electronic and paper	Gaseous fuel composition is monitored for the natural gas. The data on the natural gas composition is delivered by the gas

								supplier. Scheme of data collection, delivery and processing and responsible persons is provided in the Annex 3 of the PDD
ID-4 $EC_{HEAT,y}$	Elecric power consumption to supply heat power to consumers of the city of Zaporizhia	Technical report for CHPP operation	MWh	m	monthly	100 %	Electronic and paper	Scheme of data collection, delivery and processing and responsible persons is provided in the Annex 3 of the PDD
$EF_{CO2,i,y}$	CO_2 emission factor from fuel i combustion	For natural gas will be calculated using the formula (1.2). For mazut, coke oven gas is fixed.	tCO_2/thousand m^3 *or* tCO_2/t	c	monthly	100 %	Electronic	Choice and justification of emission factors for mazut and coke oven gas are provided in Annex 3 of PDD. Calculation of emission factor for natural gas is monthly to provide. Scheme of data collection, delivery and processing and

								responsible persons is provided in the Annex 3 of the PDD
k_i	Conversion factor of natural fuel i into standard fuel	Reference data	t of standard fuel/thousand m^3 *or* t of standard fuel/t	e	monthly	100 %	Electronic	Choice and justification of this parameter are provided in Annex 3 of PDD
$n_{C,j}$	Number of the carbon moles per mole of the gaseous fuel j-component	Reference data	-	e	monthly	100 %	Electronic	Choice and justification of this parameter are provided in Annex 3 of PDD
ρ_{CO2}	CO_2 density under the normal conditions (293 K, 101,3 kPa)	Reference data	kg/m^3	e	monthly	100 %	Electronic	Choice and justification of this parameter are provided in Annex 3 of PDD
$EF_{CO2,ELEC,grid,y}$	CO_2 emission factor during electric power generation supplied by the power grid of Ukraine	Reference data	tCO_2/MWh	e	monthly	100 %	Electronic	Choice and justification of this parameter are provided in Annex 3 of PDD

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

Project emissions:

(1) $PE_y = PE_{ELEC,own,y} + PE_{HEAT,y}$

PE_y - CO_2 project emissions, tCO_2

$PE_{ELEC,own,y}$ - CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the project scenario, tCO_2

$PE_{HEAT,y}$ - CO_2 emissions during the electric power generation used to supply the hot water to the consumers, tCO_2

Own electric power generation:

(1.1) $PE_{ELEC,own,y} = \Sigma (FC_{i,ELEC,own,PJ,y} * EF_{CO2,i,y})$

$PE_{ELEC,own,y}$ - CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the project scenario, tCO_2

$FC_{i,ELEC,own,PJ,y}$ - Fuel i consumption for electric power generation in own CHPP in the project scenario, thousand m^3 *or* t

$EF_{CO2,i,y}$ - CO_2 emission factor from fuel i combustion, tCO_2/thousand m^3 *or* tCO_2/t

(1.1.1) $FC_{i,ELEC,own,PJ,y} = FC_{ELEC,own,PJ,y} * W_{i,ELEC,own,PJ,y} / k_i$

$FC_{i,ELEC,own,PJ,y}$ - Fuel i consumption for electric power generation in own CHPP in the project scenario, thousand m^3 *or* t

$FC_{ELEC,own,PJ,y}$ - Fuel consumption for electric power generation in CHPP in the project scenario, t of standard fuel

$W_{i,ELEC,own,PJ,y}$ - Fuel i fraction in total fuel consumption for electric power generation in CHPP in the project scenario, fraction (t of standard fuel/t of standard fuel)

k_i - Conversion factor of natural fuel i into standard fuel, t of standard fuel/thousand m^3 *or* t of standard fuel/t

CO_2 emission factor from gaseous fuel combustion:

(1.2) $EF_{CO2,i,y} = \Sigma (W_{j,y} * n_{C,j} * \rho_{CO2})$

$EF_{CO2,i,y}$ - CO_2 emission factor from gaseous fuel i combustion, tCO_2/thousand m^3

$W_{j,y}$ - Volume fraction of j-component of gaseous fuel, fraction

$n_{C,j}$ - Number of the carbon moles per mole of the gaseous fuel j-component

ρ_{CO2} - CO_2 density under the normal conditions (293 K, 101,3 kPa), kg/m^3

Heat supply:

(1.3) $PE_{HEAT,y} = EC_{HEAT,y} * EF_{CO2,ELEC,grid,y}$

$PE_{HEAT,y}$ - CO_2 emissions during the electric power generation used to supply the heat power to the consumers, tCO_2

$EC_{HEAT,y}$ - Elecric power consumption to supply heat power to consumers of the city of Zaporizhia, MWh

$EF_{CO2,ELEC,grid,y}$ - CO_2 emission factor during electric power generation supplied by the power grid of Ukraine, tCO_2/MWh

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
ID-5 $P_{ELEC,TGi,PJ,y}$	Electric power generation by turbogenerator i in the project scenario	Technical report for CHPP operation	MWh	m	daily	100%	Electronic and paper	Scheme of data collection, delivery and processing and responsible persons is provided in the Annex 3 of the PDD
ID-6 $P_{HEAT,PJ,y}$	Heat power production supplied to consumers of the city of Zaporizhia in the project scenario	Technical report for CHPP operation	Gcal	m	monthly	100%	Electronic and paper	Scheme of data collection, delivery and processing and responsible persons is provided in the Annex 3 of the PDD
$ED_{BL,max}$	Maximal electrical load	Actual data	MW	e	monthly	100 %	Electronic	Choice and justification of this parameter are

	of turbogenerator in the baseline scenario							provided in Annex 3 of PDD
$EF_{CO2,ELEC,grid,y}$	CO_2 emission factor during electric power generation supplied by the power grid of Ukraine	Reference data	tCO_2/MWh	e	monthly	100 %	Electronic	Choice and justification of this parameter are provided in Annex 3 of PDD
$EF_{HEAT,y}$	CO_2 emissions factor during the heat power production which would be produced in the absence of the project activity	Estimated data	tCO_2/TJ	e	monthly	100 %	Electronic	Choice and justification of this parameter are provided in Annex 3 of PDD
$K_{TJ/Gcal}$	Conversion factor of Gcal into TJ	Reference data	TJ/Gcal	e	monthly	100 %	Electronic	Choice and justification of this parameter are provided in Annex 3 of PDD

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

Baseline emissions:

(2) $BE_y = BE_{ELEC,own,y} + BE_{ELEC,grid,y} + BE_{HEAT,y}$

BE_y - CO_2 baseline emissions, tCO_2

$BE_{ELEC,own,y}$ - CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the baseline scenario, tCO_2

$BE_{ELEC,grid,y}$ - CO_2 emissions from fuel combustion during the electric power generation supplied by the power grid of Ukraine in the baseline scenario, tCO_2

$BE_{HEAT,y}$ - CO_2 emissions from fuel combustion for heat power generation which would be produced in the absence of the project activity, tCO_2

Own electric power generation:

(2.1) $BE_{ELEC,own,y} = P_{ELEC,own,BL,y} * EF_{CO2,ELEC,own,y}$

$BE_{ELEC,own,y}$ - CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the baseline scenario, tCO_2

$P_{ELEC,own,BL,y}$ - Electric power generation in own CHPP in the baseline scenario, MWh

$EF_{CO2,ELEC,own,y}$ - CO_2 emission factor from electric power generation in own CHPP, tCO_2/MWh

(2.1.1) $P_{ELEC,own,BL,y} = \Sigma (ED_{BL,y} * 24)$

$P_{ELEC,own,BL,y}$ - Electric power generation in own CHPP in the baseline scenario, MWh

$ED_{BL,y}$ - Average daily electrical load of turbogenerator in the baseline scenario, MW

24 - Time of turbogenerator operation for 24 hours, h

In case the average daily load on the turbogenerators in the project scenario amounts to no more than 18 MW ($ED_{PJ,y} \leq 18$ MW):

(2.1.2) $ED_{BL,y} = ED_{PJ,y}$

$ED_{BL,y}$ - Average daily electrical load of turbogenerator in the baseline scenario, MW

$ED_{PJ,y}$ - Average daily electrical load of turbogenerators in the project scenario, MW

In case the average daily load on the turbogenerators in the project scenario amounts to more than 18 MW ($ED_{PJ,y} > 18$ MВт):

(2.1.3) $ED_{BL,y} = ED_{BL,max}$

$ED_{BL,y}$ - Average daily electrical load of the turbogenerator in the baseline scenario, MW

$ED_{BL,max}$ - Maximal electrical load of turbogenerator in the baseline scenario, MW

(2.1.4) $ED_{PJ,y} = \Sigma (ED_{TGi,PJ,y})$

$ED_{PJ,y}$ - Average daily electrical load of turbogenerators in the project scenario, MW

$ED_{TGi,PJ,y}$ - Average daily electrical load of the turbogenerator i in the project scenario, MW

i - Turbogenerator 1, turbogenerator 2

(2.1.5) $ED_{TGi,PJ,y} = P_{ELEC,TGi,PJ,y} / 24$

$ED_{TGi,PJ,y}$ - Average daily electrical load of the turbogenerator i in the project scenario, MW

$P_{ELEC,TGi,PJ,y}$ - Electric power generation by the turbogenerator i in the project scenario, MWh

24 - Time of turbogenerator operation for 24 hours, h

i - Turbogenerator 1, turbogenerator 2

(2.1.6) $EF_{CO2,ELEC,own,y} = PE_{ELEC,own,y} / \Sigma (P_{ELEC,TGi,PJ,y})$

$EF_{CO2,ELEC,own,y}$ - CO_2 emission factor from electric power generation in own CHPP, tCO_2/MWh

$PE_{ELEC,own,y}$ - CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the project scenario, tCO_2

$P_{ELEC,TGi,PJ,y}$ - Electric power generation by the turbogenerator i in the project scenario, MWh

i - Turbogenerator 1, turbogenerator 2

Electric power generation supplied by the power grid:

(2.2) $BE_{ELEC,grid,y} = EC_{grid,BL,y} * EF_{CO2,ELEC,grid,y}$

$BE_{ELEC,grid,y}$ - CO_2 emissions from fuel combustion during the electric power generation supplied by the power grid of Ukraine in the baseline scenario, tCO_2

$EC_{grid,BL,y}$ - Electric power supply by the power grid in the baseline scenario, MWh

$EF_{CO2,ELEC,grid,y}$ - CO_2 emission factor during electric power generation supplied by the power grid of Ukraine, tCO_2/MWh

(2.2.1) $EC_{grid,BL,y} = \Sigma (P_{ELEC,TGi,PJ,y}) - P_{ELEC,own,BL,y}$

$EC_{grid,BL,y}$ - Electric power supply by the power grid in the baseline scenario, MWh

$P_{ELEC,TGi,PJ,y}$ - Electric power generation by the turbogenerator i in the project scenario, MWh

i - Turbogenerator 1, turbogenerator 2

$P_{ELEC,own,BL,y}$ - Electric power generation in own CHPP in the baseline scenario, MWh

Heat power production:

(2.4) $BE_{HEAT,y} = P_{HEAT,PJ,y} * EF_{HEAT,y} * K_{TJ/Gcal}$

$BE_{HEAT,y}$ - CO_2 emissions from fuel combustion for heat power generation which would be produced in the absence of the project activity, tCO_2

$P_{HEAT,PJ,y}$ - Heat power production supplied to consumers of the city of Zaporizhia in the project scenario, Gcal

$EF_{HEAT,y}$ - CO_2 emissions factor during the heat power production which would be produced in the absence of the project activity, tCO_2/TJ

$K_{TJ/Gcal}$ - Conversion factor of Gcal into TJ, TJ/Gcal

D.1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

Not applicable

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Not applicable

D.1.3. Treatment of leakage in the monitoring plan:

The leakage is negligible. See the section B.3. of the PDD.

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment

Not applicable

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

Not applicable

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

(3) $ER_y = BE_y - PE_y$

ER_y - CO_2 emissions reduction, tCO_2

BE_y - CO_2 baseline emissions, tCO_2

PE_y - CO_2 project emissions, tCO_2

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

The environmental impacts' monitoring of thy project activity is determined by the following basic host party legislation:

- the Ukrainian Low "Environmental protection" from 25.06.91 # 1264-XII;
- the Ukrainian Low "Atmosphere protection" from 16.10.1992 # 2707-XII.

The project environmental impacts will be recorded by the Laboratory of the environment protection of the JSC "Zaporizhstal" in compliance with the existing procedures. The environmental impacts' monitoring includes the quantitative definition of the manufacturing activity impacts on the environment for the current period. The environmental monitoring includes recording the polluting agents' emissions into the atmosphere, manufacturing sewage release, formation and allocation of the manufacturing wastes.

The record of the data on the project environmental impacts will be done on the basis of the approved instrumental measuring and calculation methods.

The information on the project project environmental impacts is to be hold at the JSC "Zaporizhstal" and is to be delivered to the state executive jurisdiction in the form of the state statistics.

D.2. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.1.1.1 ID-1 $FC_{ELEC,own,PJ,y}$	*low*	*Measuring devices are calibrated/verified in compliance with the state regulation, in- plant standards and approved methodologies for measuring devices calibration/verification. Department of automatization and metrology of the JSC "Zaporizhstal" is responsible for calibration/verification procedures.*
Table D.1.1.1 ID-2 $W_{i,ELEC,own,PJ,y}$	*low*	*Measuring devices are calibrated/verified in compliance with the state regulation, in- plant standards and approved methodologies for measuring devices calibration/verification. Department of automatization and metrology of the JSC "Zaporizhstal" is responsible for calibration/verification procedures.*
Table D.1.1.1 ID-3 $W_{i,y}$	*low*	*The natural gas supplier presents chemical composition information in the form of certificate with physical-chemistry parameters of natural gas. Additional procedures of quality control are not foreseen.*
Table D.1.1.1 ID-4 $EC_{HEAT,y}$	*low*	*Measuring devices are calibrated/verified in compliance with the state regulation, in- plant standards and approved methodologies for measuring devices calibration/verification. Department of automatization and metrology of the JSC "Zaporizhstal" is responsible for calibration/verification procedures.*
Table D.1.1.3 ID-5 $P_{ELEC,TGi,PJ,y}$	*low*	*Measuring devices are calibrated/verified in compliance with the state regulation, in- plant standards and approved methodologies for measuring devices calibration/verification. Department of automatization and metrology of the JSC "Zaporizhstal" is responsible for calibration/verification procedures.*
Table D.1.1.3 ID-6 $P_{HEAT,PJ,y}$	*low*	*Measuring devices are calibrated/verified in compliance with the state regulation, in- plant standards and approved methodologies for measuring devices calibration/verification. Department of automatization and metrology of the JSC "Zaporizhstal" is responsible for calibration/verification procedures.*

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

The initial data to calculate the GHG emission reductions (according to tables D.1.1.1 and D.1.1.3) will be prepared monthly by the Production and technology department of the CHPP and Bureau of industrial heat energy and fuel and energy recording and then passed to the Laboratory for the environment protection. The detailed scheme of monitoring data collection, delivery and processing is provided in the Annex 3 of the PDD.

The calculation of the actual GHG emission reductions will be executed monthly by Laboratory for the environmental protection in compliance with the formulae given in the sections D 1.1. and D 1.4. To monitor the GHG emission reductions a calculation model will be used, it is elaborated in Excel.

The procedures of the initial data collection for GHG emission reductions monitoring, the data delivering and the calculation will be included to the existing reporting system of the JSC "Zaporizhstal". There is a corporate standard of JSC "Zaporizhstal" that regulates the procedures of the emissions reduction monitoring.

The initial data to calculate of GHG emission reductions and the results of the calculations will be archived in the Laboratory for the environmental protection in the course of the whole crediting period and in 2 years after this.

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

The monitoring plan has been developed by:

CJSC "National Carbon Sequestration Foundation" (Moscow);

Contact person: Mr. Roman Kazakov, principal specialist;

Tel.: +7 499 788 78 35 ext. 113

Fax: +7 499 975 78 35 ext. 107

E-mail: KazakovRA@ncsf.ru

CJSC "National Carbon Sequestration Foundation" is not a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

Assessment of GHG emission reductions is made in line with the formulae given in Section D for calculation of GHG emission reductions according to the baseline and project scenario.[18] The calculation of the emissions may be give if required. Sections E.1.-E.2. give the results of the calculation of the emissions with respect to the sources defined in section B.3.

E.1. Estimated project emissions:

Table E.1.-1. Estimated project emissions before the first commitment period

№	Parameter	Unit of measure	2005	2006	2007
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the project scenario	tCO_2 equivalent	-	-	-
2	CO_2 emissions during the electric power generation used to supply the hot water to the consumers	tCO_2 equivalent	951	906	634
3	Total CO_2 project emissions	tCO_2 equivalent	951	906	634

Table E.1.-2. Estimated project emissions during the first commitment period

№	Parameter	Unit of measure	2008	2009	2010	2011	2012
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the project scenario	tCO_2 equivalent	24,401	24,401	24,401	30,501	30,501
2	CO_2 emissions during the electric power generation used to supply the hot water to the consumers	tCO_2 equivalent	475	620	945	945	945
3	Total CO_2 project emissions	tCO_2 equivalent	24,876	25,021	25,346	31,446	31,446

[18] Calculation of GHG emission reductions is attached in excel format

Table E.1.-3. Estimated project emissions after the first commitment period

№	Parameter	Unit of measure	2013	2014	2015	2016
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the project scenario	tCO_2 equivalent	30,501	30,501	30,501	30,501
2	CO_2 emissions during the electric power generation used to supply the hot water to the consumers	tCO_2 equivalent	945	945	945	945
3	Total CO_2 project emissions	tCO_2 equivalent	31,446	31,446	31,446	31,446

Table E.1.-3. Estimated project emissions after the first commitment period (continuation)

№	Parameter	Unit of measure	2017	2018	2019	2020
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the project scenario	tCO_2 equivalent	30,501	30,501	30,501	30,501
2	CO_2 emissions during the electric power generation used to supply the hot water to the consumers	tCO_2 equivalent	945	945	945	945
3	Total CO_2 project emissions	tCO_2 equivalent	31,446	31,446	31,446	31,446

E.2. Estimated leakage:

The leakage is negligible. See the section B.3. of the PDD.

E.3. The sum of E.1. and E.2.:

Table E.3.-1. Estimated project emissions and leakage before the first commitment period

№	Parameter	Unit of measure	2005	2006	2007
1	Project scenario	tCO_2 equivalent	951	906	634

2	Leakage	tCO_2 equivalent	-	-	-
3	Total emissions	tCO_2 equivalent	951	906	634

Table E.3.-2. Estimated project emissions and leakage during the first commitment period

№	Parameter	Unit of measure	2008	2009	2010	2011	2012
1	Project scenario	tCO_2 equivalent	24,876	25,021	25,346	31,446	31,446
2	Leakage	tCO_2 equivalent	-	-	-	-	-
3	Total emissions	tCO_2 equivalent	24,876	25,021	25,346	31,446	31,446

Table E.3.-3. Estimated project emissions and leakage after the first commitment period

№	Parameter	Unit of measure	2013	2014	2015	2016
1	Project scenario	tCO_2 equivalent	31,446	31,446	31,446	31,446
2	Leakage	tCO_2 equivalent	-	-	-	-
3	Total emissions	tCO_2 equivalent	31,446	31,446	31,446	31,446

Table E.3.-3. Estimated project emissions and leakage after the first commitment period (continuation)

№	Parameter	Unit of measure	2017	2018	2019	2020
1	Project scenario	tCO_2 equivalent	31,446	31,446	31,446	31,446
2	Leakage	tCO_2 equivalent	-	-	-	-
3	Total emissions	tCO_2 equivalent	31,446	31,446	31,446	31,446

E.4. Estimated baseline emissions:

Table E.4.-1. Estimated baseline emissions before the first commitment period

№	Parameter	Unit of measure	2005	2006	2007
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the baseline scenario	tCO_2 equivalent	-	-	-
2	CO_2 emissions from fuel combustion during the electric power generation supplied by the power grid of Ukraine in the baseline scenario	tCO_2 equivalent	-	-	-
3	CO_2 emissions from fuel combustion for heat power generation which would be produced in the absence of the project activity	tCO_2 equivalent	14,269	16,558	17,932
4	Total CO_2 baseline emissions	tCO_2 equivalent	14,269	16,558	17,932

Table E.4.-2. Estimated baseline emissions during the first commitment period

№	Parameter	Unit of measure	2008	2009	2010	2011	2012
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the baseline scenario	tCO_2 equivalent	18,300	18,300	18,300	18,300	18,300
2	CO_2 emissions from fuel combustion during the electric power generation supplied by the power grid of Ukraine in the baseline scenario	tCO_2 equivalent	44,800	44,800	44,800	89,600	89,600
3	CO_2 emissions from fuel combustion for heat power generation which would be produced in the absence of the project activity	tCO_2 equivalent	15,394	13,672	23,450	23,450	23,450
4	Total CO_2 baseline emissions	tCO_2 equivalent	78,494	76,772	86,550	131,350	131,350

Table E.4.-3. Estimated baseline emissions after the first commitment period

№	Parameter	Unit of measure	2013	2014	2015	2016
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the baseline scenario	tCO_2 equivalent	18,300	18,300	18,300	18,300
2	CO_2 emissions from fuel combustion during the electric power generation supplied by the power grid of Ukraine in the baseline scenario	tCO_2 equivalent	89,600	89,600	89,600	89,600
3	CO_2 emissions from fuel combustion for heat power generation which would be produced in the absence of the project activity	tCO_2 equivalent	23,450	23,450	23,450	23,450
4	Total CO_2 baseline emissions	tCO_2 equivalent	131,350	131,350	131,350	131,350

Table E.4.-3. Estimated baseline emissions after the first commitment period (continuation)

№	Parameter	Unit of measure	2017	2018	2019	2020
1	CO_2 emissions from fuel combustion during the electric power generation in own CHPP in the baseline scenario	tCO_2 equivalent	18,300	18,300	18,300	18,300
2	CO_2 emissions from fuel combustion during the electric power generation supplied by the power grid of Ukraine in the baseline scenario	tCO_2 equivalent	89,600	89,600	89,600	89,600
3	CO_2 emissions from fuel combustion for heat power generation which would be produced in the absence of the project activity	tCO_2 equivalent	23,450	23,450	23,450	23,450
4	Total CO_2 baseline emissions	tCO_2 equivalent	131,350	131,350	131,350	131,350

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

Table E.5.-1. Estimated emission reductions before the first commitment period

№	Parameter	Unit of measure	2005	2006	2007
1	Difference between E.4. and E.3. representing the emission reductions of the project	tCO_2 equivalent	13,318	15,652	17,298

Table E.5.-2. Estimated emission reductions during the first commitment period

№	Parameter	Unit of measure	2008	2009	2010	2011	2012
1	Difference between E.4. and E.3. representing the emission reductions of the project	tCO_2 equivalent	53,618	51,751	61,204	99,904	99,904

Table E.5.-3. Estimated emission reductions after the first commitment period

№	Parameter	Unit of measure	2013	2014	2015	2016
1	Difference between E.4. and E.3. representing the emission reductions of the project	tCO_2 equivalent	99,904	99,904	99,904	99,904

Table E.5.-3. Estimated emission reductions after the first commitment period (continuation)

№	Parameter	Unit of measure	2017	2018	2019	2020
1	Difference between E.4. and E.3. representing the emission reductions of the project	tCO_2 equivalent	99,904	99,904	99,904	99,904

E.6. Table providing values obtained when applying formulae above:

Table E.6.-1. Table containing results of emission reductions estimation before the first commitment period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2005	951	-	14,269	13,318
2006	906	-	16,558	15,652

2007	634	-	17,932	17,298
Total (tonnes of CO_2 equivalent)	2,491	-	48,759	46,268

Table E.6.-2. Table containing results of emission reductions estimation during the first commitment period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2008	24,876	-	78,494	53,618
2009	25,021	-	76,772	51,751
2010	25,346	-	86,550	61,204
2011	31,446	-	131,350	99,904
2012	31,446	-	131,350	99,904
Total (tonnes of CO_2 equivalent)	138,135	-	504,516	366,381

Table E.6.-3. Table containing results of emission reductions estimation after the first commitment period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2013	31,446	-	131,350	99,904
2014	31,446	-	131,350	99,904
2015	31,446	-	131,350	99,904
2016	31,446	-	131,350	99,904
2017	31,446	-	131,350	99,904
2018	31,446	-	131,350	99,904
2019	31,446	-	131,350	99,904
2020	31,446	-	131,350	99,904
Total (tonnes of CO_2 equivalent)	251,568	-	1,050,800	799,232

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundaries impacts, in accordance with procedures as determined by the host Party:

An environmental impact assessment (EIA) of a project is an integral and binding part of the design documentation for construction, expansion, reconstruction and so on of any economic or industrial facility.

The EIA of the project is fulfilled on the stage of the project documentation elaboration in compliance with the requirements of the environmental legislation of Ukraine:

- The Ukrainian Low “Environmental protection” from 25.06.91 # 1264- XII.
- DBN A.2.2-1-2003 “Project making. Containing of environmental impact assessment (EIA) while project and construction of factories, buildings and facilities” approved by order of Gosstroy of Ukraine from 15.12.2003 # 214 and implemented since 01.04.2004.

Information on the project’s EIA is given in project documentation:

- Reconstruction of external thermal nets from CHPP-PVS to TK P9. Environment impact assessment (EIA). Claim report concerning ecological consequences. DT 340050, Volume 2, GP “Giproprom”, 2003.
- Overhaul with reconstruction of blast furnace #2. Environmental impact assessment (EIA). DT 336456, Volume 2, GP “Ukrgipromez”, 2000.

The results of the project’s EIA show that the project implementation will not bring to a significant impact on the environment. Main conclusions are shown below.

Construction and exploitation of external thermal nets are characterized by the absence of pollution emissions into the atmosphere and waste water release in the natural reservoirs. For the thermal nets construction there is no need in earth resources use and deforestation. There are no wastes in the process of thermal nets exploitation. Poisonous impact factors (electromagnetic and ionized radiation, ultrasound, noise) are absent. Transboundary effect is absent as there are no sources polluting the atmosphere.

Implementation of steam boiler and turbogenerator is performed on the industrial area of CHPP. So threre is no need in earth use and deforestation. Noise impact on living areas from CHPP stops by the technical noise protection measures (setting of smoke exhausters and fans in isolated facilities, connection of fans to air transporting net through flexible embeddings, implementation of noise equipment on vibration isolated basement, construction of noise protectors in the air delivery and so on). Consider screening capacity of building facilities, noise impact on living areas will be negligible.

Implementation of new gas-mazut boiler on CHPP will allow to reduce emissions of air pollutants by virtue of smoke gases system recycling and strait flowing of swirl burner. Emission reductions of pollutants (nitrogen dioxide, sulphur dioxide, carbon oxide) into the atmosphere from CHPP sources is 25%. Transboundary effect is absent.

Waste water releases are absent. Water supply performing by the reverse scheme without waste water release in pounds from the following cycles:

- “clean” reverse cycle of CHPP-PVS of blast and martin furnaces. It includes main pump station (GNS), spray pond, chimney-type cooling tower.
- “durty” reverse cycle of gas cleaning blast furnaces that includes clearing compartment, evaporation of sludge, preparation of reagents etc. Cooled and cleared water is supplied on gas cleaning in blast furnaces. Sludge is transported on sinter plant for utilization.

Wastes that cannot be utilized are absent.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The results of the environmental impact assessment are subjects to the state expertise (The law of Ukraine "About environmental expertise" № 45/95-BP dated on 09.02.1995). The environmental expertise establishes the compliance of the expected economic or other activity with the environmental requirements and defines the legality of the implementation of the target of the environmental expertise to prevent the possible unfavorable impact of its activity on the environment and the social, economic and other consequences of the environment expertise target implementation related to it.

The positive conclusion of the state environmental expertise proves the compliance of the project events with the current legislation in the sphere of the environmental protection, i.e. it proves the acceptable level of the project impact on the environment at all the stages of its implementation (starting from the construction and up the taking out of service).

The project obtained the positive conclusion of the state environmental expertise proves from Ministry for Environmental Protection of Ukraine.

The JSC "Zaporizhstal" has all the necessary permissions for the sources of the pollution emissions. *This documentation is available on request.*

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

The stakeholder' comments on the project of the turbogenerator installation at the heat station of the JSC "Zaporizhstal" and the supply of the city of Zaporizhia with the heat power were not held on the basis of the requirements of the Ukrainian legislation about the stakeholder' comments:

1. The order of the Ministry for Environmental Protection of Ukraine "About the participation of the public in taking decisions in the sphere of the environment protection" №168, as of 18.12.2003, Official report of Ukraine ,2004, №6 , p.357
2. State building norms A.2.2-1-2003 "Design. Composition and content of the materials of assessment of the impacts on the environment during designing and constructing the enterprises, buildings and structures". Approved by the order of the state construction jurisdiction of Ukraine as of 15.12.2003, № 214 put into operation from 01.04.2004.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organization:	JSC “Zaporizhstal”
Street/P.O.Box:	Pivdenne shosse
Building:	72
City:	Zaporizhia
State/Region:	Zaporizhia oblast (region)
Postfix/ZIP:	69008
Country:	Ukraine
Telephone:	+38 (061)218-33-01, +38 (061) 218-34-14
FAX:	+38 (061) 213-18-58
E-Mail:	zstal@zaporizhstal.com
URL:	http://www.zaporizhstal.com/
Represented by:	
Title:	Deputy Director Technical
Salutation:	Mr.
Last Name:	Lykov
Middle Name:	Abramovych
First Name:	Aleksandr
Department:	
Mobile tel:	+ 38 (061) 218-33-30
Direct FAX:	-
Direct tel:	-
Personal E-Mail:	Lykov@zaporizhstal.com

Annex 2

BASELINE INFORMATION

The additional information in the baseline is as follows:

1. Table containing the key elements of the baseline (including variables, parameters and data sources)
2. The description of plausible alternative scenarios and analysis of their correspondence with the technical regulation and implementation availability
3. The boundaries of the project
4. Production and supply of the electric power to the JSC "Zaporizhstal" in 2005-2007
5. CO_2 emissions factor from the electric power generation supplied by the power grid of Ukraine for the projects consuming the electric power
6. Blast-furnace gas balance for the period of 2005 to 2007
7. Main technical specifications of the steam turbine and the generator in the baseline scenario

Table containing the key elements of the baseline (including variables, parameters and data sources)

(Detailed information about choice and justification of key elements is provided in the section B.1.)

№	Parameter	Description	Value	Source
1.	$P_{ELEC,own,BL,y}$	Electric power production at own CHPP in the baseline scenario	Year – MWh 2008 – 150,000 2009 – 150,000 2010 – 150,000 2011 – 150,000 2012 – 150,000	Estimated
2.	$EC_{grid,BL,y}$	Electric power supply by the power grid in the baseline scenario	Year – MWh 2008 – 50,000 2009 – 50,000 2010 – 50,000 2011 – 100,000 2012 – 100,000	Estimated
3.	$P_{HEAT,PJ,y}$	Heat power production supplied to the consumers of the city of Zaporizhia	Year – Gcal 2008 – 65,646 2009 – 58,300 2010 – 100,000 2011 – 100,000 2012 – 100,000	Actual data and forecast
4.	$EF_{CO2,ELEC,grid,y}$	CO_2 emission factor during electric power generation supplied by the power system of Ukraine for the projects consuming electric power	0.896 tCO_2/MWh	Reference data
5.	$ED_{BL,max}$	Maximal electric load of the turbogenerator according to the baseline scenario	18.0 MW	Estimated
6.	$K_{TJ/Gcal}$	Conversion factor of Gcal into TJ	0.00418 TJ/Gcal	Reference data
7.	$EF_{CO2,ELEC,own,y}$	CO_2 emission factor from electric power generation in own CHPP	0.122 tCO_2/MWh	Estimated
8.	$EF_{HEAT,y}$	CO_2 emission factor by heat power production which would be produced in the absence of the project activity	56.1 tCO_2/TJ	Estimated

Subproject – blast-furnace gas utilization. Plausible alternative scenarios and their description.

Alternative scenario	Description		
	Electric power production	**Blast-furnace gas utilization**	**Correspondence with the technical regulation / implementation availibility**
1	Installation of the steam boiler with the capacity of up to 150 t steam/h and the turbogenerator with the capacity of 35 MW.[19] Operation of the turbogenerator with the available capacity 18 MW without reconstruction. Electric power production using the blast-furnace gas. Annual output of the electric power will amount to ca 200,000 MWh.	Blast-furnace gas will be efficiently utilize in the CHPP of the JSC "Zaporizhstal" due to the putting into operation the additional facility to produce the electric power. Additional amount of the blast-furnace gas utilization as compared to the pre-project situation will amount to ca 250 mln m^3 per year.	This scenario foreseeing the installation of new steam boiler and turbogenerator and operation of the turbogenerator with the available capacity 18 MW is fully in line with the technical regulation. *This scenario does not contradict the technical regulation and is available for the project participants.*
2	The reconstruction and the further operation of the turbogenerator with the available capacity of 18 MW without steam boiler replacement.[20] Electric power production using the blast-furnace gas. Annual output of the electric power will amount to ca 150,000 MWh, the remaining part of the electric power will be supplied by the power grid of Ukraine, this is about 50,000 MWh.	Blast-furnace gas is utilized to produce the electric power in the CHPP of the JSC "Zaporizhstal". Available capacity of the turbogenerator (18 MW) does not permit to fully utilize the blast-furnace gas. Redundant blast-furnace gas will be flared.	Further operation of the turbogenerator with the available capacity of 18 MW after the reconstruction does not contradict the technical legislation of Ukraine. In compliance with the "Rules for technical operation of the power stations and networks" the pool resources for the turbines with the working temperature of steam less than 450°C are not installed. The required measures[21] will allow to prolong the service life of the turbogenerator for more than 10 years. There are not legislative instructions on the efficient utilization of the redundant technological gases in Ukraine. *This scenario does not contradict the technical*

[19] Project implementation without its registration as a JI project

[20] Later will be showed that this alternative scenario is the baseline

[21] The list of required measures for turbogenerator with available capacity 18 MW reconstruction can be provided on request

Alternative scenario	Description		
	Electric power production	**Blast-furnace gas utilization**	**Correspondence with the technical regulation / implementation availibility**
			regulation and is available for the project participants.
3	Further operation of the turbogenerator with the available capacity of 18 MW without any reconstruction. Electric power production using the blast-furnace gas. Annual output of the electric power will amount to ca 150,000 MWh, the remaining part of the electric power will be supplied by the power grid of Ukraine, this is about 50,000 MWh.	Blast-furnace gas is utilized to produce the electric power in the CHPP of the JSC “Zaporizhstal”. Available capacity of the turbogenerator (18 MW) does not permit to fully utilize the blast-furnace gas. Redundant blast-furnace gas will be flared.	Further operation of the turbogenerator without the reconstruction does not contradict the technical legislation of Ukraine. In compliance with the “Rules for technical operation of the power stations and networks” the pool resources for the turbines with the working temperature of steam less than 450°C are not installed. However, in the absence of required measures on turbogenerator reconstruction its further operation will not allow to supply the reserved consumers with the electric power due to the equipment runout. *This scenario is excluded from the further consideration*[22]*, as it contradicts the technical regulation*.
4	Construction of new turbogenerator which will produce the electric power using the fossil fuel.	Blast-furnace gas is not used at the CHPP of the JSC “Zaporizhstal” for electric power production. The redundant blast-furnace gas if it is not used by the other consumers is flared.	To produce the electric power, the JSC “Zaporizhstal” uses as a fossil fuel the natural gas mainly. Taking into account the increasing prices for the natural gas, the cost of producing the electric power using the natural gas only is higher than the price for electric power supplied by the power grid of Ukraine. Due to this, the JSC “Zaporizhstal” is limited in producing its own

[22] Alternative scenario 3 results in the same GHG emissions as the Alternative scenario 2 (or to the larger GHG emissions, if the available capacity of turbogenerator will be decreased). Thus, the further consideration of the Alternative scenario 2 and excluding from the consideration the Alternative scenario 3 are the *conservative approach* concerning the obtained GHG emissions reduction.

Alternative scenario	Description		
	Electric power production	**Blast-furnace gas utilization**	**Correspondence with the technical regulation / implementation availibility**
			electric power by the blast-furnace resources (see Alternative scenarios 1 and 2). Power generating coal as a fuel is not to be used because of technological particularities of the boiler equipment in CHPP of JSC "Zaporizhstal". *This scenario is excluded from the further considering as it is not available to the project participants (it is not profitable taking into account the financial indices)*
5	To stop producing the electric power in own CHPP (turbogenerators are taken out of service). Electric power is supplied by the power grid.	Blast-furnace gas is not used at the CHPP of the JSC "Zaporizhstal" for electric power production. The redundant blast-furnace gas if it is not used by the other consumers is flared.	This scenario can not be implemented as it fails to supply the reserved consumers of the works with the electric power in case the outer source of electric power is cut off. *This scenario is excluded from the further consideration, as it contradicts the technical regulation.*
6	To stop producing the electric power in own CHPP (turbogenerators are taken out of service). Electric power is produced using the renewable sources of energy.	Blast-furnace gas is not used at the CHPP of the JSC "Zaporizhstal". The redundant blast-furnace gas if it is not used by the other consumers is flared.	The JSC "Zaporizhstal" has no possibility to arrange the power stations using the renewable sources of energy. *This scenario is excluded from the further consideration, as it is not available to the project participants.*

Subproject – waste heat utilization. Plausible alternative scenarios and their descriptions.

Alternative scenario	Description		
	Heat power production	**Waste heat utilization**	**Correspondence with the technical regulation / implementation availability**
1	Utilization the waste heat of the ECS and the WHB of the blast-furnaces and the open-hearth furnaces of the JSC “Zaporizhstal” to produce the hot water in the heating units with the further its supply to the consumers of the city of Zaporizhia. To supply the hot water to the consumers the reconstruction of the heat networks is carried on. Seasonal supply of the heat power will amount of 70,000 to 120,000 Gcal per year.[23]	Waste heat of the ECS and the WHB of the blast furnaces and the open-hearth furnaces of the JSC “Zaporizhstal” is used to produce the hot water in the heating unit.	*This scenario does not contradict the technical regulation*[24] *and is available to the project participants.*
2	The consumers of the city of Zaporizhia are supplied with the hot water in the required level by the city boiler plants working on the natural gas. Waste heat at the JSC “Zaporizhstal” is not used: steam of the ECS is thrown into atmosphere, the WHB are taken out of service.[25]	Redundant waste heat of the ECS and the WHB of the blast furnaces and the open-hearth furnaces of the JSC “Zaporizhstal” is not used.	*This scenario does not contradict the technical regulation and is available to the project participants.*
3	The consumers of the city of Zaporizhia are supplied with the hot water by the JSC “Zaporizhstal” due to the production of steam in the steam boilers, with the fossil fuel (natural gas) or technological fuel (blast-furnace gas, coke	Redundant waste heat of the ECS and the WHB of the blast furnaces and the open-hearth furnaces of the JSC “Zaporizhstal” is not used.	This scenario does not contradict the technical regulation. However, the cost of the heat power produced with using of the fossil or technological fuel is higher than heat power produced with using the waste heat of the ECS and WHB of the blast

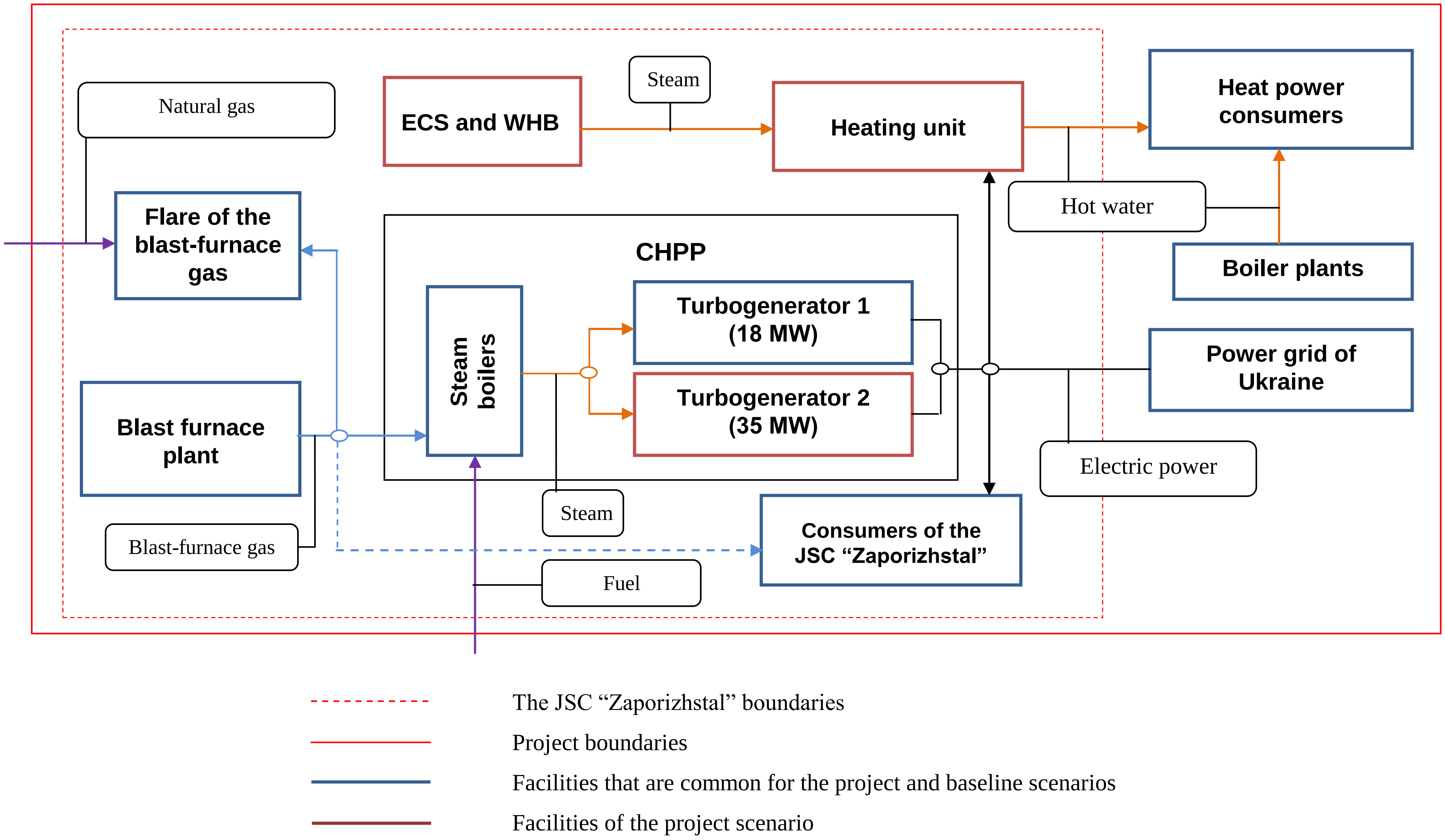
[23] The project implementation without its registration as a JI project

[24] Technical regulation for this and other alternative scenarios of the subproject “waste heat utilization” includes: Rules for technical operation of the power stations and networks, approved by order # 296 of Ministry of fuel and energy of Ukraine dated on 13.06.2003; Rules for technical operation of heat station and networks, approved by order # 71 of Ministry of fuel and energy of Ukraine dated on 14.02.2007

[25] Later will be showed that this alternative scenario is the baseline

Alternative scenario	Description		
	Heat power production	**Waste heat utilization**	**Correspondence with the technical regulation / implementation availability**
	oven gas) are being used. To supply the hot water to the consumers, the reconstruction of the heat networks is carried on. Seasonal supply of the heat power will amount of 70,000 to 120,000 Gcal per year.		furnaces and the open-hearth furnaces. The further investment analysis of the Alternative scenario 1 will show that this scenario is not economically profitable. Taking into account that the investment volume to implement the Alternative scenarios 1 and 3 is the same and the cost of the heat power for the alternative scenario is higher than that for the alternative scenario 3, we can make a conclusion that the implementation of the alternative scenario 3 is not available for the project participants. *This scenario is excluded from the further considering as it is not available to the project participants (it is not profitable taking into account the financial indices)*
4	The consumers of the city of Zaporizhia are supplied with the hot water by other industrial enterprises (except the JSC "Zaporizhstal") produced heat power using waste heat, waste technological gases or alternative sources of energy.	Redundant waste heat of the ECS and the WHB of the blast furnaces and the open-hearth furnaces of the JSC "Zaporizhstal" is not used.	The project scenario implementation (Alternative scenario 1) made it possible to provide 2 districts of the city of Zaporizhia with the heat. The remaining districts are supplied with the heat by the city boiler plants. For the last 5 years no project on supplying the consumers of the city of Zaporizhia with the hot water by the other industrial enterprises (except the JSC "Zaporizhstal") using waste heat, waste technological gases or the alternative sources of energy was implemented. *This scenario is excluded from the further considering.*

The boundaries of the project



Production and supply of the electric power to the JSC "Zaporizhstal" in 2005-2007

Index	2005	2006	2007
Electric power production in CHPP of the JSC "Zaporizhstal", MWh	116,787	112,843	116,018
Electric power supplied to the JSC "Zaporizhstal" from the power grid, MWh	1,757,069	1,813,642	1,792,626
Electric power consumtion at the JSC "Zaporizhstal", MWh	1,873,886	1,926,485	1,908,644

CO_2 emissions factor from the electric power generation supplied by the power grid of Ukraine[26]

Index	Dimention	2008	2009	2010	2011	2012
Emission factor	tCO_2 / MWh	0.896	0.896	0.896	0.896	0.896

Blast-furnace gas balance for the period of 2005 to 2007.

№	Parameter	Unit of measure	Year				
			2003	2004	2005	2006	2007
1	**Blast-furnace gas flow**	**mln. m^3**	**6,067.5**	**6,433.0**	**6,952.1**	**6,833.8**	**6,710.0**
	Consumption						
2	Blust air heater of blust furnaces	mln. m^3	1,766.5	1,869.6	2,460.3	2,422.4	2,404.6
3	Interbell space of blust furnace	mln. m^3	69.5	71.7	75.0	71.6	76.9
4	Unfreezing ore garage	mln. m^3	21.4	14.7	20.1	15.7	14.0
5	Heating well of slabbing mill shop	mln. m^3	598.2	617.1	706.5	735.8	745.0
6	Continuous furnace	mln. m^3	219.1	218.3	204.9	172.1	181.0
7	Steam boiler CHPP	mln. m^3	2,614.3	2,668.9	2,726.6	2,708.4	2,703.2
8	Third party consumers - Dniprospetsstal	mln. m^3	158.6	196.4	256.7	266.8	244.8
9	**Total blast-furnace gas consumption**	**mln. m^3**	**5,447.6**	**5,656.7**	**6,450.1**	**6,392.9**	**6,369.5**
10	**Flared blast-furnace gas**	**mln. m^3**	**619.9**	**776.3**	**502.0**	**440.9**	**340.5**

[26] Source: Global Carbon B. V.: "Ukraine - Assessment of new calculation of CEF"

Main technical specifications of the steam turbine

№	Parameter	Unit of measure	Value
1	Manufacturer	-	Leningrad metal works
2	Model	-	AP-25-2
3	Frequency of rotor rotation	rot/min	3,000
4	Steam pressure	atm	29
5	Steam temperature	°C	400
6	Cooling water temperature	°C	20
7	Cooling water consumption	m^3/h	5,000
8	Total cooling surface of the condenser	m^2	2,000
9	Absolute pressure of the heat extraction	kgs/cm^2	-
10	Nominal capacity	MW	25
11	Installed capacity	MW	18
12	Steam consumption at the condensation mode	t/h	130
13	Steam consumption maximal	t/h	330

Main technical specifications of the generator

№	Name	Unit of measure	Value
1	Manufacturer	-	“HTGZ”, Harkiv
2	Model	-	TGV-25
3	Nominal capacity at the generator terminals	MW	25
4	Efficiency factor of the generator at the condensation mode	%	97,1
5	Specific consumption of the steam at the condensation mode	kg/кWh	5,2
6	Specific consumption of the heat at the condensation mode	kcal/кWh	3,700

Annex 3

MONITORING PLAN

The additional information for the monitoring plan:

1. Parameters which are determined once and are taken as constants for the whole monitoring period and are available at the stage of determination

2. Description of the methods for calculated parameters of the monitoring plan determination

3. Scheme of monitoring data collection, delivery and processing

4. Description of the scheme of monitoring data collection, delivery and processing

Parameters which are determined once and are taken as constants for the whole monitoring period and are available at the stage of determination

Data / parameter	$\mathbf{EF_{CO2,i,y}}$
Data unit	tCO_2/t
Description	CO_2 emission factor from fuel oil combustion
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated parameter
Value of data (for ex ante calculations/determinations)	3.127
Justification of the choice of data or description of measurement methods and procedures (to be) applied	*Formula for calculation:* $EF_{CO2,i,y} = EF_{CO2,i,default} * NCV_{i,default} * 10^{-3}$ $EF_{CO2,i,default}$ - default emission factor from fuel oil combustion, tCO_2/TJ $NCV_{i,default}$ – default Net calorific value of fuel oil, TJ/th. t *Data for calculation:* $EF_{CO2,i,default}$ = 77.4 tCO_2/TJ $NCV_{i,default}$ = 40.4 TJ/th. t *Source of data:* IPCC Guidelines for National Greenhouse Gas Inventories, 2006 – Volume 2: Energy, Chapter 1: Introduction, Table 1.2, p. 1.18, Table 1.4, p. 1.23
QA/QC procedures (to be) applied	-
Any comment	The value of the actual average NCVof fuel oil (used at the JSC “Zaporizhstal”) amounts to no less than 40.5 TJ/th. t. That corresponds to 95% confidence interval of default NCV (IPCC).

Data / parameter	**$EF_{CO2,i,y}$**
Data unit	tCO_2/th. m^3
Description	CO_2 emission factor from coke oven gas combustion
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated parameter
Value of data (for ex ante calculations/determinations)	0.770
Justification of the choice of data or description of measurement methods and procedures (to be) applied	*Formula for calculation:* $EF_{CO2,i,y} = EF_{CO2,i,default} * NCV_{i,default} * \rho_i * 10^{-3}$ $EF_{CO2,i,default}$ - default emission factor from coke oven gas combustion, tCO_2/TJ $NCV_{i,default}$ – default Net calorific value of coke oven gas, TJ/th. t ρ_i – average actual density of coke oven gas, kg/m^3 *Data for calculation:* $EF_{CO2,i,default}$ = 44.4 tCO_2/TJ $NCV_{i,default}$ = 38.7 TJ/th. t ρ_i = 0.448 kg/m^3 *Source of data:* IPCC Guidelines for National Greenhouse Gas Inventories, 2006 – Volume 2: Energy, Chapter 1: Introduction, Table 1.2, p. 1.18, Table 1.4, p. 1.23 Actual data on the chemical composition and physical and chemical parameters of the coke oven gas used at the JSC “Zaporizhstal”
QA/QC procedures (to be) applied	-
Any comment	The value of the actual average NCVof coke oven gas (used at the JSC “Zaporizhstal”) is 37.5 TJ/th. t. That corresponds to 95% confidence interval of default NCV (IPCC).

Data / parameter	**ρ_{CO2}**
Data unit	kg/m^3
Description	Carbon dioxide (CO_2) density under the normal conditions (293 K, 101.3 кPa)
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Methodology of the calculation of the pollution emissions into the atmosphere during the associated petroleum gas flaring, Research institute “Atmosphere”, 1998.

Value of data (for ex ante calculations/determinations)	1.831
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$n_{C,j}$**
Data unit	-
Description	Number of the carbon moles per mole of the gaseous fuel component
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	IPCC Guidelines for National Greenhouse Gas Inventories, 2006 – Volume 2: Energy, Chapter 4, Fugitive Emissions, p. 4.45
Value of data (for ex ante calculations/determinations)	$n_{C,CO}$ = 1; $n_{C,CO2}$ = 1; $n_{C,CH4}$ = 1; $n_{C,C2H6}$ = 2; $n_{C,C3H8}$ = 3; $n_{C,C4H10}$ = 4; $n_{C,C5H12}$ = 5.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$EF_{CO2,ELEC,grid,y}$**
Data unit	tCO_2/MWh
Description	CO_2 emission factor during the electric power generation supplied by the power grid of Ukraine for the projects consuming electric power
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Global Carbon B. V.: “Ukraine - Assessment of new calculation of CEF”
Value of data (for ex ante calculations/determinations)	0.896

Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$ED_{BL,max}$**
Data unit	MW
Description	Maximal electrical load of the turbogenerator in the baseline scenario
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Estimated based on actual data
Value of data (for ex ante calculations/determinations)	18
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Maximal electrical load of the turbogenerator in the baseline scenario is determined based on analysis of daily electrical load of the turbogenerator in period of three last years operation (2005-2007). The provided analysis makes it clear that average maximal electrical load of the turbogenerator was 15.6 – 15.9 MW and was not more than 17.7 MW. For calculation of baseline emissions is to use the value of maximal electric load (18 MW) that ensures the conservative assumption of GHG emissions reduction calculation.
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**k_i**
Data unit	t of standard fuel / th. m^3 *or* t of standard fuel / t
Description	Conversion factor of natural fuel into standard fuel
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Instruction for order of enterprise’s fuel and energy balance compilation, Moscow, 1985 – p. 63-65.

Value of data (for ex ante calculations/determinations)	Blast-furnace gas: 0.114 t of standard fuel / th.m^3 Coke oven gas: 0.571 t of standard fuel / th. m^3 Natural gas: 1.150 t of standard fuel / th. m^3 Mazut: 1.107 t of standard fuel / t
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$K_{TJ/Gcal}$**
Data unit	TJ/Gcal
Description	Convertion factor of Gcal into TJ
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	V. Kudrin. Theory and technology of steel production: manual for the higher educational institutions. – Moscow: Mir, 2003 - p. 503
Value of data (for ex ante calculations/determinations)	0.00418
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$EF_{HEAT,y}$**
Data unit	tCO_2/TJ
Description	CO_2 emissions factor during the heat power production which would be produced in the absence of the project activity
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated parameter
Value of data (for ex ante calculations/determinations)	56.1

Justification of the choice of data or description of measurement methods and procedures (to be) applied	*Formula for calculation:* $EF_{HEAT,y} = EF_{CO2,i,default} / \eta_{HG,i}$ $EF_{CO2,i,default}$ - default emission factor from natural gas combustion, tCO_2/TJ $\eta_{HG,i}$ – efficiency factor of the heat power production. *Data for calculation:* $EF_{CO2,i,default}$ = 56.1 tCO_2/TJ $\eta_{HG,i}$ = 1 (*or* 100%) *Source of data:* IPCC Guidelines of the national inventory of the greenhouse gases, 2006 – volume 2 Power, Chapter 1, Introduction, table 1.4, page 1.26 Efficiency factor of the heat power production is assessed (comment below).
QA/QC procedures (to be) applied	-
Any comment	In the absence of the project activity the heat power would be produced by the boiler plants of the city of Zaporizhia with natural gas being used. The efficiency factor of the heat power generation is taken to equal to 100% for conservative assessment.

Description of the methods for calculated parameters of the monitoring plan determination

1. Fuel consumption for electric power generation in the CHPP in the project scenario (ID-1, $FC_{ELEC,own,PJ,y}$) is determined based on “Instruction for completing of the technical report about heat economy of an electric power station according to the form #3-tech(m), Moscow, 1986” and “Methodic recommendation for analysis of electricity consumption for turboaggregates and feed-pumps of an electric power station”, Moscow, 1984» applied the following formulae:

(1) $B_{от,эл} = B_{ТЭЦ} * [Q_э / ((Q_{к,бр} – Q_{к,сн} – Q_м) * η_{тп})] * [Э_{от,ТЭЦ} / (Э_{выр,ТЭЦ} - Э_э)]$

$B_{от,эл}$ - Fuel consumption for electric power generation in the CHPP, t of standard fuel *(Data variable according to the PDD: $FC_{ELEC,own,PJ,y}$)*

$B_{ТЭЦ}$ - Fuel consumption in boilers of the CHPP, t of standard fuel *(Calculated according to the formula (1.1))*

$Q_э$ - Steam consumption for electric power generation, Gcal

$Q_{к,бр}$ - Gross steam production in boilers of the CHPP, Gcal

$Q_{к,сн}$ - Steam consumption for boilers’ auxiliaries of the CHPP, Gcal *(Calculated according to the formula (1.2))*

$Q_м$ - Physical heat of fuel oil, Gcal *(Calculated according to the formula (1.3))*

$η_{тп}$ - Coefficient of steam’s flow *(Calculated according to the formula (1.4))*

$Э_{от,ТЭЦ}$ - Electric power supplied from the CHPP, MWh

$Э_{выр,ТЭЦ}$ - Electric power generation by the turbogenerators of the CHPP, MWh

$Э_э$ - Electric power consumption for CHPP’s auxiliaries refered to electric power generation , MWh *(Calculated according to the formula (1.5))*

(1.1) $B_{ТЭЦ} = Σ (B_i * k_i)$

$B_{ТЭЦ}$ - Fuel consumption in boilers of the CHPP, t of standard fuel

B_i - Fuel i consumption in boilers of the CHPP, thousand m^3 *or* t

k_i - Conversion factor of natural fuel into standard fuel, t of standard fuel / th. m^3 *or* t of standard fuel / t

(1.2) $Q_{к,сн} = Q_{к,бр} * \eta_{к.сн}$

$Q_{к,сн}$ - Steam consumption for boilers' auxiliaries of the CHPP, Gcal

$Q_{к,бр}$ - Gross steam production in boilers of the CHPP, Gcal

$\eta_{к.сн}$ - Steam consumption for boilers' auxiliaries of the CHPP in percent, %

(1.3) $Q_м = B_м * c_т * (t_м - t_{исх}) * 10^{-3}$

$Q_м$ - Physical heat of fuel oil, Gcal

$B_м$ - Fuel oil consumption in boiler of the CHPP, t

$c_т$ - Average heat capacity of fuel oil, kcal/kg grad

$t_м$ - Temperature of fuel oil combusted in boilers, °C

$t_{исх}$ - Temperature of fuel oil supplied to the CHPP, °C

(1.4) $\eta_{тп} = (1 - Q_{тп}/(Q_{к,бр} - Q_{к,сн}))$

$\eta_{тп}$ - Coefficient of steam's flow

$Q_{тп}$ - Losses of steam's flow, %

$Q_{к,бр}$ - Gross steam production in boilers of the CHPP, Gcal

$Q_{к,сн}$ - Steam consumption for boilers' auxiliaries of the CHPP, Gcal *(Calculated according to the formula (1.2))*

(1.5) $Э_э = Э_{к,э} + Э_{тг,сн}$

$Э_э$ - Electric power consumption for CHPP's auxiliaries referred to electric power generation , MWh

$Э_{к,э}$ - Electric power consumption for boilers' auxiliaries referred to electric power generation , MWh *(Calculated according to the formula (1.5.1))*

$Э_{тг,сн}$ - Electric power consumption for turbogenerators' auxiliaries, MWh *(Calculated according to the formula (1.5.3))*

(1.5.1) $\mathbf{Э_{к,э} = Э_{к,сн} * (Q_э / (Q_{к,бр} – Q_{к,сн} – Q_м) * η_{тп}}$

$Э_{к,э}$ - Electric power consumption for boilers' auxiliaries referred to electric power generation , MWh

$Э_{к,сн}$ - Electric power consumption for boilers' auxiliaries, MWh *(Calculated according to the formula (1.5.2))*

$Q_э$ - Steam consumption for electric power generation, Gcal

$Q_{к,бр}$ - Gross steam production in boilers of the CHPP, Gcal

$Q_{к,сн}$ - Steam consumption for boilers' auxiliaries of the CHPP, Gcal *(Calculated according to the formula (1.2))*

(1.5.2) $\mathbf{Э_{к,сн} = Э_{тэц.сн} - Э_{твд.сн} - Э_{тг.сн} - Э_{тф.сн}}$

$Э_{к,сн}$ - Electric power consumption for boilers' auxiliaries, MWh

$Э_{тэц,сн}$ - Electric power consumption for CHPP's auxiliaries, MWh

$Э_{твд,сн}$ - Electric power consumption for turboblastaggregates' auxiliaries, MWh *(Calculated according to the formula (1.5.3))*

$Э_{тг,сн}$ - Electric power consumption for turbogenerators' auxiliaries, MWh *(Calculated according to the formula (1.5.3))*

$Э_{тф,сн}$ - Electric power consumption for heating units' auxiliaries, MWh *(Calculated according to the formula (1.5.3))*

(1.5.3) $\mathbf{Э_{i,сн} = (3)^{1/2} * U * I_i * \cos φ_н}$

$Э_{i,сн}$ - Electric power consumption for auxiliaries, MWh

i - Turboblastaggregates, turbogenerators, heating units

U - Voltage on the buses of the CHPP, V

I_i - Current load, A

$\cos φ_н$ - Coefficient for electric motors

Parameter	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
ID-1 $FC_{ELEC,own,PJ,y}$	Fuel consumption for electric power generation in CHPP in the project scenario	Calculated according to the formula (1)	t of standard fuel	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP. Data are recorded in the Technical report for CHPP operation
$B_{ТЭЦ}$	Fuel consumption in boilers of the CHPP	Calculated according to the formula (1.1)	t of standard fuel	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP. Data are recorded in the Technical report for CHPP operation
$Q_{э}$	Steam consumption for electric power generation	Meters	Gcal	Measured	Daily	100 %	Electronic and paper	Data collection – CEA of CHPP. Data processing – Bureau of IHE and FER
$Q_{к,бр}$	Gross steam production in boilers of the CHPP	Meters	Gcal	Measured	Daily	100 %	Electronic and paper	Data collection – CEA of CHPP. Data processing – Bureau of IHE and FER
$Q_{к,сн}$	Steam consumption for boilers' auxiliaries of the CHPP	Calculated according to the formula (1.2)	Gcal	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP. Data are recorded in the Technical report for CHPP operation
$Q_{м}$	Physical heat of fuel oil	Calculated according to the formula (1.3)	Gcal	Calculated	Monthly	100 %	Electronic	Responsible for calculation - PTD of CHPP
$\eta_{тп}$	Coefficient of steam's flow	Calculated according to the	-	Calculated	Monthly	100 %	Electronic	Responsible for calculation - PTD of

		formula (1.4)						CHPP
$Э_{от,ТЭЦ}$	Electric power supplied from the CHPP	Meters	MWh	Measured	Daily	100 %	Electronic and paper	Data collection – EDP of CHPP. Data processing – PTD of CHPP
$Э_{выр,ТЭЦ}$	Electric power generation by the turbogenerators of the CHPP	Meters	MWh	Measured	Daily	100 %	Electronic and paper	Data collection – EDP of CHPP. Data processing – PTD of CHPP
$Э_э$	Electric power consumption for CHPP's auxiliaries referred to electric power generation	Calculated according to the formula (1.5)	MWh	Calculated	Monthly	100 %	Electronic	Responsible for calculation - PTD of CHPP
B_i	Fuel i consumption in boilers of the CHPP	Meters	thousand m^3 *or* t	Measured	Daily	100 %	Electronic and paper	Consumption of natural gas, coke oven gas, blast-furnace gas and fuel oil. Data collection – CEA of CHPP, CEA of gaseous department. Data processing – Bureau of IHE and FER, PTD of CHPP
k_i	Conversion factor of natural fuel into standard fuel	Instruction for order of enterprise's fuel and energy balance compilation, Moscow, 1985 – p. 63-65.	t of standard fuel / thousand m^3 *or* t of standard fuel / t	Estimated	Monthly	100 %	Electronic and paper	Fixed parameter. The values of conversion factor are provided in the Annex 3 PDD
$\eta_{к.сн}$	Steam consumption for boilers' auxiliaries of the	Estimated based on actual data of CHPP operation	%	Estimated	Monthly	100 %	Electronic	Responsible for calculation - PTD of CHPP.

	CHPP in percent	in range of 4.4-4.6%						
$c_т$	Average heat capacity of fuel oil	Fixed parameter (0.51 kcal/kg grad)	kcal/kg grad	Estimated	Monthly	100 %	Electronic	Fixed parameter
$t_м$	Temperature of fuel oil combusted in boilers	Fixed parameter (120°C)	°C	Estimated	Monthly	100 %	Electronic	Fixed parameter
$t_{исх}$	Temperature of fuel oil supplied to the CHPP	Fixed parameter (0°C)	°C	Estimated	Monthly	100 %	Electronic	Fixed parameter
$Q_{тп}$	Losses of steam's flow	Fixed parameter (1.5%). Instruction for report #6-tp complection	%	Estimated	Monthly	100 %	Electronic	Fixed parameter
$Э_{к,э}$	Electric power consumption for boilers' auxiliaries referred to electric power generation	Calculated according to the formula (1.5.1)	MWh	Calculated	Monthly	100 %	Electronic	Responsible for calculation - PTD of CHPP
$Э_{тг,сн}$	Electric power consumption for turbogenerators' auxiliaries	Calculated according to the formula (1.5.3)	MWh	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP
$Э_{к,сн}$	Electric power consumption for boilers' auxiliaries	Calculated according to the formula (1.5.2)	MWh	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP
$Э_{тэц,сн}$	Electric power consumption for CHPP's auxiliaries	Meters	MWh	Measured	Monthly	100 %	Electronic and paper	Data collection – EDP of CHPP. Data processing – PTD of CHPP
$Э_{твд,сн}$	Electric power consumption for turboblastaggregates' auxiliaries	Calculated according to the formula (1.5.3)	MWh	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP.

$Э_{тф,сн}$	Electric power consumption for heating units' auxiliaries	Calculated according to the formula (1.5.3)	MWh	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP.
U	Voltage on the buses of the CHPP	Fixed parameter (3,600 V)	V	Measured	Daily	100 %	Electronic and paper	Fixed parameter
I_i	Current load	Meters	A	Measured	Daily	100 %	Electronic and paper	Data collection – Turbine department of CHPP. Data processing – PTD of CHPP
cos $φ_н$	Coefficient for electric motors	Technical passports of electric motors	-	Estimated	Monthly	100 %	Electronic and paper	Responsible for estimation - PTD of CHPP.

2. Fuel i fraction in total fuel consumption for electric power generation in CHPP in the project scenario (ID-2, $W_{i,ELEC,own,PJ,y}$) is calculated according to the following formula:

(2) $$W_{i,ELEC,own,PJ,y} = (B_i * k_i) / \Sigma (B_i * k_i)$$

$W_{i,ELEC,own,PJ,y}$ - Fuel i fraction in total fuel consumption for electric power generation in CHPP in the project scenario, fraction (t of standard fuel/t of standard fuel)

B_i - Fuel i consumption in boilers of the CHPP, thousand m^3 *or* t

k_i - Conversion factor of natural fuel into standard fuel, t of standard fuel / th. m^3 *or* t of standard fuel / t

Parameter	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
ID-2 $W_{i,ELEC,own,PJ,y}$	Fuel i fraction in total fuel consumption for electric power generation in CHPP in the project scenario	Calculated according to the formula (2)	Fraction or t of standard fuel / t of standard fuel	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP. Data are recorded in the Technical

								report for CHPP operation
B_i	Fuel i consumption in boilers of the CHPP	Meters	thousand m^3 *or* t	Measured	Daily	100 %	Electronic and paper	Consumption of natural gas, coke oven gas, blast-furnace gas and fuel oil. Data collection – CEA of CHPP, CEA of gaseous department. Data processing – Bureau of IHE and FER, PTD of CHPP
k_i	Conversion factor of natural fuel into standard fuel	Instruction for order of enterprise's fuel and energy balance compilation, Moscow, 1985 – p. 63-65.	t of standard fuel / thousand m^3 *or* t of standard fuel / t	Estimated	Monthly	100 %	Electronic and paper	Fixed parameter. The values of conversion factor are provided in the Annex 3 PDD

3. Electric power consumption to supply heat power to consumers of the city of Zaporizhia (ID-4, $EC_{HEAT,y}$) is determined based on "Methodic recommendation for analysis of electricity consumption for turboaggregates and feed-pumps of an electric power station", Moscow, 1984» according to the following formula:

(3) $Э_{сн} = (3)^{1/2} * U * I * \cos \varphi_н$

$Э_{сн}$ - Electric power consumption for auxiliaries, MWh *(Data variable according to the PDD: $EC_{HEAT,y}$)*

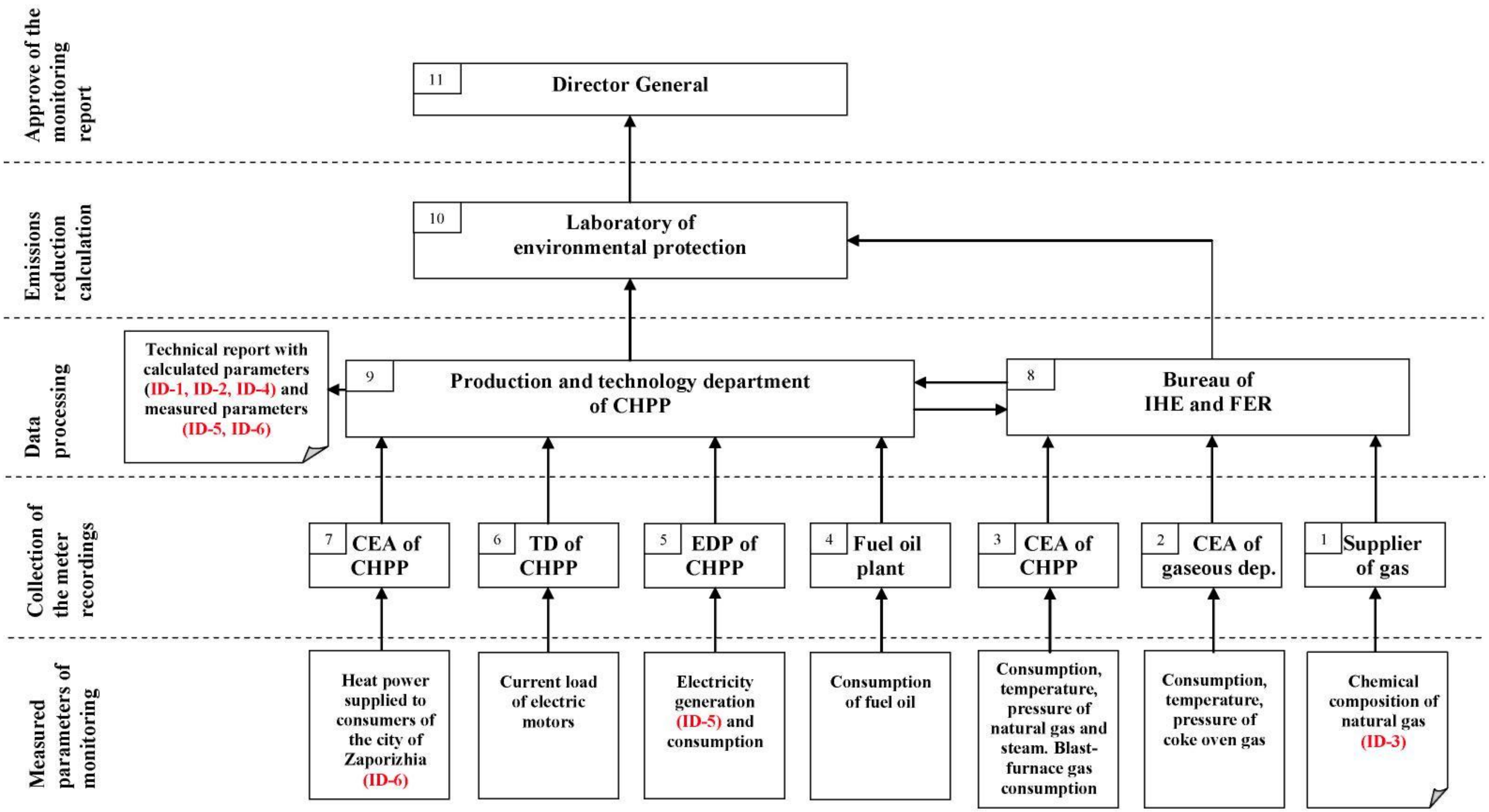
U - Voltage on the buses of the CHPP, V

I_i - Current load, A

$\cos \varphi_н$ - Coefficient for electric motors

Parameter	Data variable	Source of data	Data unit	Measured, calculated, estimated	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
ID-4 $EC_{HEAT,y}$	Electric power consumption to supply heat power to consumers of the city of Zaporizhia	Calculated according to the formula (3)	MWh	Calculated	Monthly	100 %	Electronic and paper	Responsible for calculation - PTD of CHPP. Data are recorded in the Technical report for CHPP operation
U	Voltage on the buses of the CHPP	Fixed parameter (3,600 V)	V	Measured	Daily	100 %	Electronic and paper	Fixed parameter
I	Current load	Meters	A	Measured	Daily	100 %	Electronic and paper	Data collection – Turbine department of CHPP. Data processing – PTD of CHPP
cos φн	Coefficient for electric motors	Technical passports of electric motors	-	Estimated	Monthly	100 %	Electronic and paper	Responsible for estimation - PTD of CHPP.

Scheme of monitoring data collection, delivery and processing



Description of the scheme of monitoring data collection, delivery and processing

№	Department	Responsible persons	Function for monitoring	Frequency
1	**Supplier of natural gas**	-	Provides daily measurement of the physical-chemistry parameters of the **natural gas**. Delivers the results of the measurement to the Bureau of IHE and FER daily by telephone and monthly on paper.	Monthly
2	**CEA of gaseous department**	**Master CEA**	Takes charts of consumption, temperature, pressure of the **coke oven gas** during the day. Delivers the charts to the Bureau of IHE and FER.	Daily
3	**CEA of CHPP**	**Master CEA**	Takes charts of consumption, temperature, pressure of the **natural gas** and the **steam** produced by the CHPP's boilers and consumed by turbogenerators. Takes meter readings of the blast-furnace gas consumption in CHPP. Delivers data to the Bureau of IHE and FER on paper.	Daily
4	**Fuel oil plant**	**Machinist, Head of shift**	Machinist measures the level of the **fuel oil** in reservoirs by means of a measuring scale and records the data in the daily logbook. Head of shift calculates the daily **fuel oil** consumption based on the recording data. Delivers data of fuel oil consumption to the PTD of CHPP on paper.	Daily
5	**EDP of CHPP**	**Electrician for equipment maintenance**	Takes electricity meter readings, calculates the electricity consumption and records the data in the daily logbook on paper. Delivers the daily logbook to the PTD of CHPP on paper. Also the electricity meter readings and electricity consumption is archived in computer system for technical recording of electricity.	Daily

6	**Turbine department of CHPP**	**Machinist of turbo-compressor aggregate**	Takes ampermeters readings and records the data in the daily logbook on paper. The daily logbook is to deliver to the PTD of CHPP on paper.	6 time per day
7	**CEA of CHPP**	**Mechanic of CEA**	Takes heatmeters readings and records the data in the daily logbook on paper. The daily logbook is to deliver to the PTD of CHPP on paper.	Daily
8	**Bureau of IHE and FER**	**Power-engineer**	Power-engineer collects monthly the physical-chemistry parameters of the **natural gas** from the Supplier of natural gas on paper. Delivers the volume fraction of j-components of gaseous fuel (ID-3) to Laboratory of environmental protection on paper and electronic Archives the data electronic and paper. Bureau of IHE and FER collects from CEA of CHPP, CEA of gaseous department and PTD of CHPP data on paper about consumption of **blast-furnace gas** and **fuel oil;** consumption, temperature, pressure of the **coke oven gas, natural gas** and **steam**. **Power-engineer** of **Bureau of IHE and FER** estimates the consumption of coke oven gas, natural gas and steam according to the planimetrist's instruction. Data about fuel consumption are recorded and archived in computer system for fuel and energy recording. Data are archived on paper and electronic.	Daily / monthly

9	**PTD of CHPP**	**Head**	PTD of CHPP collects data about **fuel oil consumption** on paper and delivers that to Bureau of IHE and FER. PTD of CHPP collects data about **fuel and energy consumption** from computer system for fuel and energy recording electronic; **electricity consumption (ID-5)** from EDP of CHPP on paper**; current load** of electric motors from Turbine department of CHPP on paper; **heat power** supplied to consumers of the city of Zaporizhia (ID-6) from CEA of CHPP on paper. Calculated based on collected data parameters (fuel consumption for electric power generation in CHPP in t of standard fuel – ID-1; fuel i fraction in total fuel consumption for electric power generation in CHPP – ID-2; elecric power consumption to supply heat power to consumers of the city of Zaporizhia – ID-4) are recorded in the Technical report for CHPP operation. Initial data, calculation and technical reports are archived on paper or electronic. PTD of CHPP delivers monthly to Laboratory of environmental protection the data for emissions reduction monitoring **(ID-1, 2, 4, 5, 6)** on paper and electronic.	Monthly

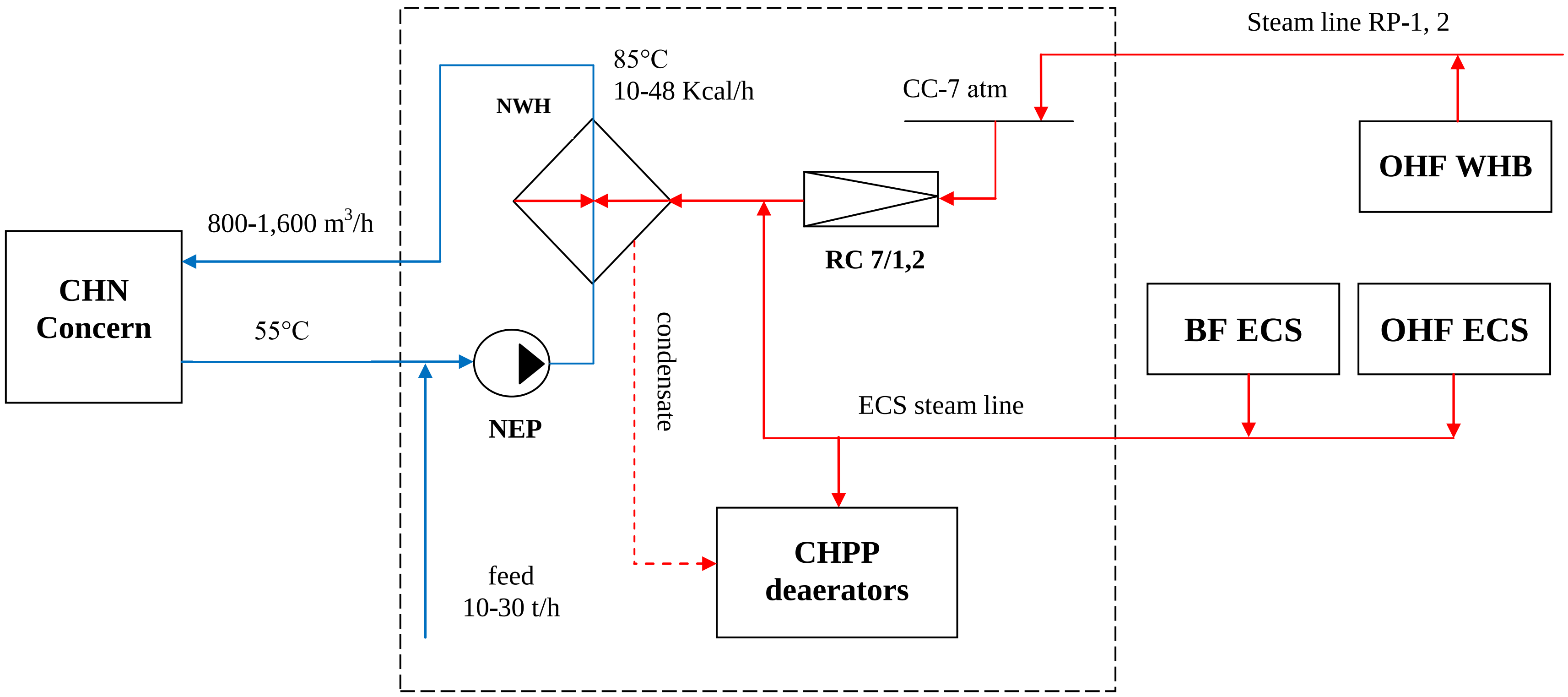
10	**Laboratory of environmental protection**	**Head**	Collects data **(ID-1, 2, 4, 5, 6)** from PTD of CHPP data **(ID-3)** from Bureau of IHE and FER on paper and electronic. Head of Laboratory of environmental protection calculates emissions reduction in excel format. Initial data for monitoring (according to the monitoring plan), emissions reduction calculation, results of calculation are archived in Laboratory of environmental protection on paper and electronic.	Monthly
11	**-**	**Director general**	Approves the monitoring report	Yearly

Annex 4

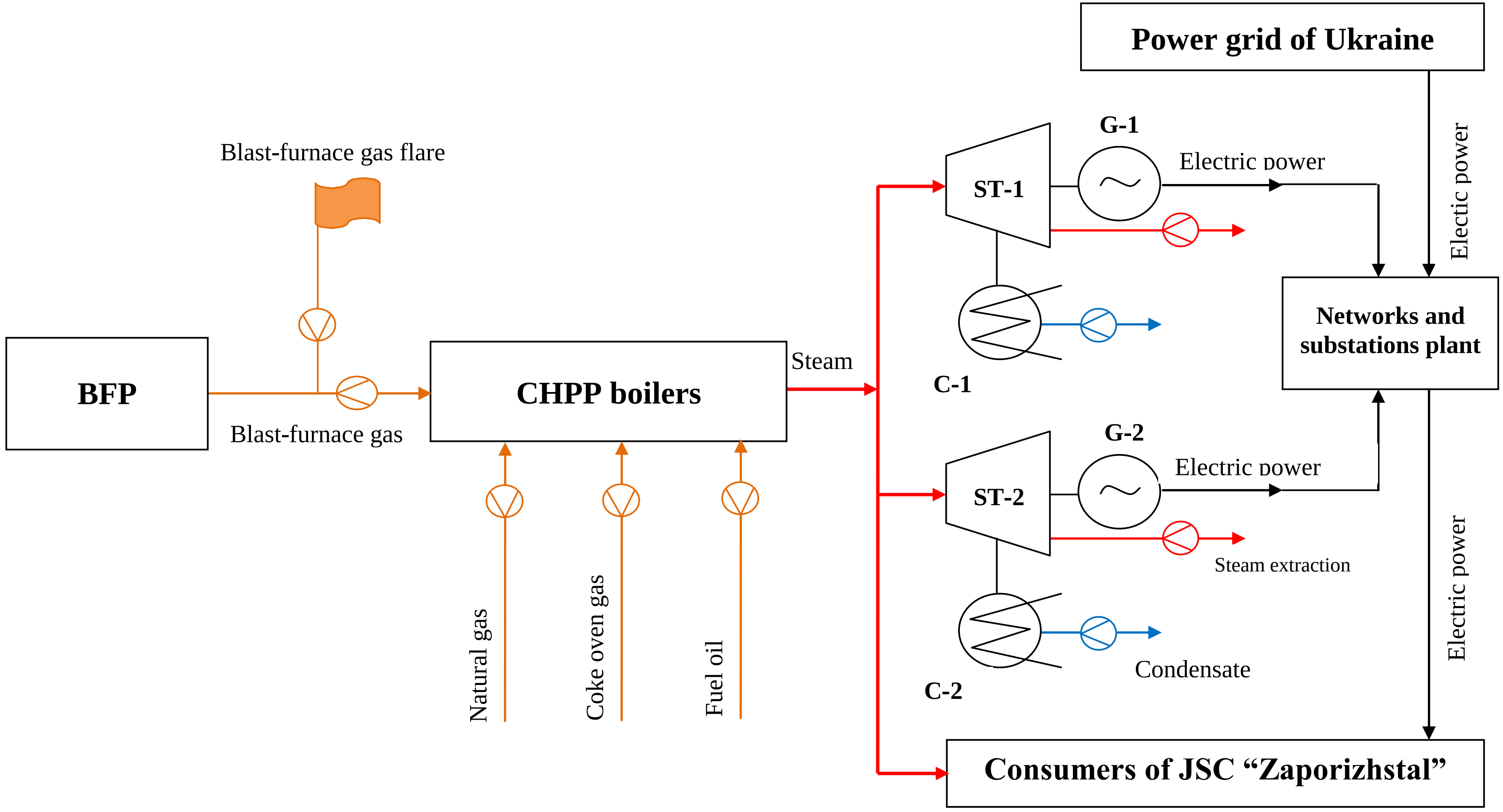
TECHNOLOGICAL PRODUCTION SCHEMES AND EQUIPMENT

Scheme of generation and supply of heat power by the CHPP of the JSC “Zaporizhstal” to the city of Zaporizhia

Main building CHPP



Electric power generation scheme at CHPP of the JSC "Zaporizhstal"



Annex 5

ABBREVIATION USED IN THE PDD

BF - blast-furnaces

BFP - blast furnaces plant

C - condenser

CC - consumer collector

CHN - city heat networks

CHPP - combined heat and power plant

ECS - evaporation cooling system

EIA - environmental impact assessment

ERU - emissions reduction units

G - generator

GHG - greenhouse gases

HU - heating unit

JI - joint implementation

NEP - network electric pump

NWH - network water heater

OHF - open-hearth furnaces

RP - rolling plant

RC - reducing camera

ST - stem turbine

TC - thermal camera

WHB - waste heat boiler

CEA - control equipment and automatization

IHE and FER - industrial heat energy and fuel and energy recording

PTD - production and technology department

EDP - electricity distribution plant

TD - turbine department