THIRD PERIODIC ANNUAL JI MONITORING REPORT

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SECTION A. General Project activity information

A.1 Title of the project activity:

Utilization of coke gas with electricity generation by two 6 MWe CHP at "ZaporozhCox" Plant"

Sectoral scope: 1. Energy industries (renewable / non-renewable sources)

Date: 09 November 2012

Version: 2.1

A.2. JI registration number:

ITL number: UA2000026

A.3. Short description of the project activity:

The concept of the project is generation of electricity onsite to partially cover own needs; as well as to use COG[1] in a more efficient way. For this purpose, energy of steam which, in the absence of the project, was desuperheated in PRDS (pressure-reducing and desuperheating stations) which were used for correction of parameters of steam. The project foresees using of this superheated steam in the two 6 MWe turbines instead of PRDS. Therefore, additional electricity will be generated and consumed onsite.

A.4. Monitoring period:

- Monitoring period starting date: 01/04/2011.
- Monitoring period closing date .31/08/2012[2].

A.5. Methodology applied to the project activity (incl. version number):

The JI specific approach is used for the monitoring of emission reductions.

A.5.1. Baseline methodology:

The main principles of the JI specific approach is described by the following:

1. Setting of the baseline is based on real data (project scenario), obtained during the years before and after the project realization.
2. Estimated values of the key parameters under the project activity are based on the project owner's forecasts.
3. The proposed project concerns electricity generation only as a part of combined heat and power production cycle.
4. The proposed project doesn't influence on the COG production level. Therefore, amount of COG for the project scenario and for the baseline scenario is assumed to be the same for each year.
5. In general, proposed project doesn't influence technological heat/steam demand level. Both turbines under the project are considered as substitutions of the PRDS units that were used for the steam parameters correction. However, some differences are considered in heat generation level due to principle of operation of the condensing turbine, as appropriate.

[1] Coke oven gas

[2] Both days are included.

6. All significant leakages are taken into consideration.
7. The project implementation results in an increase in electricity consumption due to the installation of the new equipment or modernization of the existing one. However, this electricity is considered as carbon neutral because it is generated from the waste heat.

A.5.2. Monitoring methodology:

The reduction of GHG emissions due to additional electricity is generated with the same level of heat production with respect to the baseline scenario. Therefore, the amount of emission reductions is calculated based on the monitoring data for the electricity generated by the project.

The baseline emissions will be calculated based on the following inputs:

1. All electricity generated by the project from the COG is carbon neutral;

2. Electricity generated by the project from the COG and consumed by ZCP's auxiliaries applies an Emission Factor (EF) of:

CO_2 emission factor for electricity consumed by the project activity in period y is accepted by the DFP and is based on actual power plants data according with *Calculation methodology for specific carbon dioxide emissions from electric energy production at thermal power plants and its consumption, National Environmental Investment Agency of Ukraine (NEIA), 2011*[11]. This methodology and the resulting specific carbon dioxide emissions have been developed by the DFP of Ukraine for the application in JI projects. Estimated specific carbon dioxide emissions for the years 2011 and 2012 are available[12]. It is approved that actual ex-post emission factors will be calculated and published every year for the previous year before the 1st of March. For ex-ante estimations in this monitoring report the most recent available value of specific carbon dioxide emissions is used for the whole estimation period. Ex-ante value of specific carbon dioxide emissions will be used if available for the calculation of emission reductions. In case this value is not available the most recent available value will be used instead.

The proposed CHP does not require any additional COG cleaning before fuelling the boiler, so there is no consumption of electricity for cleaning of COG. Additional electricity will be consumed by new equipment installed within the limits of the proposed CHP during operation (generator). This electricity is carbon neutral, because CHP will be fuelled by COG, which is flared and burnt in the existing boiler houses at the moment. However, auxiliary electricity consumption would not occur in the absence of the proposed project, so it is substituted from the amount of electricity generated by new CHP.

In accordance with the PDD the only leakage that takes place is the additional consumption of fuel at site of the external consumers, to cover the lack of COG which had been delivered, and now is used for condensing turbine.

Taking into account the information given above, the following parameters are monitored:

1. Amount of electricity, generated by new turbines under the project activity
2. Amount of electricity consumed by project equipment
3. Amount of COG, which would not be supplied to external consumers due to the project activity. This value is calculated by the difference between steam input and steam output amounts of condensing turbine, in accordance with the project conditions.
4. Amount of other fossil fuel have been combusted during the monitoring period, if any. This parameter was not included into the tables D.1.2.1 and D.1.3.1 as well as there is no reflection of this parameter

[11] http://www.neia.gov.ua/nature/doccatalog/document?id=125381
[12] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

in any formulas of the MR, because everything depends on fossil fuel type. For every monitoring period AIE finds out if any fossil fuel has been combusted in mixture with COG. In this case relevant emissions are calculated using IPCC default factors and relevant NCV.

A.6. Status of implementation including time table for major project parts:

As it was planned, the first turbine was installed on the 14th of February 2008. Installation of the second turbine was postponed from the planned date (March 2010) due to lack of financing. Now all assembling works are finished and turbine was put into operation in June 2010.

Activity	Commissioning date in accordance with PDD	Actual commissioning date
Commissioning of the first turbine	2008	March 2008
Commissioning of the second turbine	March 2010	June 2010

Table 1: Implementation plan

A.7. Intended deviations or revisions to the determined PDD:

Monitored amount of emissions reductions (ER) differs from the one expected in PDD for the respective period stated in A.4. As shown in the table below:

Parameter	2011*	2012**
ER in this report in tonnes of CO_2 equivalent	43888	39549
ER in determined PDD in tonnes of CO_2 equivalent ***	48 611	48 611

Table 1: Monitored amount of ERUs and expected in PDD

* Period from 01.04.2011 till 31.12.2011. Hereinafter in this report in tables values for 2011 are referring to this period

** Period from 01.01.2012 till 31.08.2012. Hereinafter in this report in tables values for 2012 are referring to this period

*** Recalculated for respective monitoring period in this report.

The differences are considered significant and are explained by the following:

- The estimates in the PDD were based on forecasted data for amount of COG which is burn in boiler for steam production. Production of COG depends on level production of cokes, which in turn depends on demand in the energy market.

Name of the enterprise, which implements this project, has been changed in the reported monitoring period. The name of the enterprise was changed from Open Joint Stock Company "Zaporozhcoke" to Public Joint Stock Company "Zaporozhcoke" with accordance to certificate #029703 and #557120. With accordance to Regulations of PJSC "Zaporozhcoke" new status came into force at 06/07/2012. The reason of this change was Law of Ukraine "On Joint Stock Companies" #514-VI dated September 17, 2008.

A.8. Intended deviations or revisions to the determined monitoring plan:

According to the PDD electricity generated by the project from the COG and consumed by ZCP's auxiliaries apply an Emission Factor (EF) of 0.896 tCO_2/MWh as a project reducing electricity consumption from the grid. The emission factor for the Ukrainian electricity grid, developed by Global Carbon B.V., determined by TUV SUD and final determined by the JISC, will be used for the baseline emissions calculation. At the time of determination, it was the most accurate Emission Factor for electricity production in Ukraine.

In 2011 the National Environmental Investment Agency of Ukraine issued Order #75[3], which had set new Emission Factors for electricity production. New emission factor is based on recent studies of fuel consumption for electricity production in Ukraine. Therefore, in this monitoring report is used new Emission Factor.

Source of the data for determining emission factor for natural gas in the determined monitoring plan was IPCC 2006. Changes were made to estimate emissions for the reporting period in this monitoring report. In particular, the emission factor for natural gas is determined by calculating method on the basis of the data from National Inventory Report of Ukraine. This parameter is calculated as follows:

$$EF_{NG} = k^{c}{}_{NG,y} \cdot OXID_{NG,y} \cdot \frac{44}{12}, \text{ where}$$

$k^{c}{}_{NG,y}$ - Carbon content for natural gas, tC/TJ;

$OXID_{NG,y}$ - Carbon oxidation factor, ratio;

$\frac{44}{12}$ - Ration between molecular mass of CO_2 and C. Reflect oxidation of C to CO_2.

Parameters of carbon content in natural gas and oxidation factor for natural gas are set in accordance with the new actual data that are published annually in the National Inventory Report of Ukraine. The proposed change is detailed in a table below:

Approved monitoring plan			**Revised monitoring plan**		
Value	**Unit**	**Value**	**Unit**	**Value**	**Unit**
EF_{NG}	tCO_2/TJ	Description: Emission factor for natural gas Source of data (to be) used: IPCC 2006 Time of determination/verification: Fixed ex-ante. Values of data applied: 56.1 .	EF_{NG}	tCO_2/TJ	Description: Emission factor for natural gas Source of data (to be) used: This coefficient is calculated on the basis of data from National Inventory Report of Ukraine 1990-2010 according to the formula: $EF_{NG} = k^{c}{}_{NG,y} \cdot OXID_{NG,y} \cdot \frac{44}{12}$ Time of determination/verification: Ex-post according to the publicly available data . Values of data applied: it is calculated according to equation above.
			$k^{c}{}_{NG,y}$	tC/TJ	Description: Carbon content of natural gas Source of data (to be) used: National Inventory Report of Ukraine 1990-2010 p. 470 (value for stationary combustion, heat and power generation)

[3] http://document.ua/pro-zatverdzhennja-pokaznikiv-pitomih-vikidiv-dvookisu-vugle-doc65115.html (last reference - 14.09.2012)

					Time of determination/verification: Ex-post according to the publicly available data Values of data applied: 15.17
			$OXID_{NG,y}$	ratio	Description: Carbon oxidation factor for natural gas. Source of data (to be) used: National Inventory Report of Ukraine 1990-2010 p. 471 (value for stationary combustion, heat and power generation) Time of determination/verification: Ex-post according to the publicly available data . Values of data applied: 0.995.

Table 3: Changes to the monitoring plan.

A.9. Changes since last verification:

Not applicable.

A.10. Person(s) responsible for the preparation and submission of the monitoring report:

PJSC "ZaporozhCox"
- Galina Fedkova, Head of investment department

Global Carbon B.V.
- Dmytro Kosolukin, JI Consultant

A.11. Person(s) responsible for the checking and approval of the monitoring report:

PJSC "ZaporozhCox"
- Musa Magomedov, General Director

Global Carbon B.V.
- Denis Prusakov, Team Leader JI Consultants

SECTION B. Key monitoring activities according to the monitoring plan for the monitoring period stated in A.4.

For the monitoring period stated in A.4. the following parameters are collected and registered:

1. **Electricity generated by the new turbines № 1 and № 2.**

   This parameter is metered with a specialized meters "Alpha A1140" (for more information please see Table B.1.2). The meter is situated next to current transformers. Readings are registered automatically and the results are going to the control panel. After that these results are loaded to the database. Moreover, once per shift the electrician writes the meter readings into the log book. These data are forwarded to the head of energy department to be recalculated (summarized). A summary for each calendar month is sent to the Chief Electrician. The annual reports are based on these monthly reports.

2. **Electricity consumed by the project equipment.**

   For metering of this parameter separate meters "Energiya-9" and "Alpha A1140" are used (for more information please see Table B.1.2). These meters work in parallel or sequentially, depending on situation. The devices are located on several current inputs, next to current transformers. Readings are registering automatically and results are transmitted to the control panel. After that they are sent to the database. Moreover, once per shift the electrician writes down the meter readings into the log book. These data are going to the head of energy department to be recalculated (summarized). Summary for the month is sent to the Chief Electrician. Monthly and annual reports are based on these data.

3. **Amount of COG, which would not be supplied to external consumers due to the project activity.**

   This value is calculated, subject to project conditions. There is a difference between steam input and steam output amounts of condensing turbine #2 calculated using the thermal equivalent of steam. Special device in the Automatic system for technological process control (ASTPC) will measure temperature, pressure and flow of steam. ASTPC is used for registering, transforming into heat equivalent and storing the data simultaneously. The operator prints the daily technical reports and sends them to the superintendent of the boiler-turbine shop. At the same time, these data are fed to chief power engineering specialist, which are summed up and form the monthly and annual reports.

Also, in accordance with determined monitoring plan, it is checked if other fossil fuel source was used simultaneously with COG during monitoring period.

B.1. Monitoring equipment types

1. Electricity meters "Alpha A1140";
2. Electricity meters "Energiya-9" ver. STK3;
3. Temperature sensors "THK-1-1";
4. Pressure sensors "Metran 100";
5. Flow of steam sensors "Metran 100".

B.1.2. Table providing information on the equipment used (incl. manufacturer, type, serial number, date of installation, date of last calibration, information to specific uncertainty, need for changes and replacements):

Meter ID number	Parameter name	Units	Meter name	Serial number	Accuracy index	Date of installation	The last check date	The next check date	Notes
1	Electricity generated by the new turbine № 1	kWh	Alpha A1140	05002014	1	2008	14.04.2008	14.04.2014	10.11.08 this meter was installed instead of "Energiya -9", serial number 37017
2	Electricity consumed by the new turbine № 1	kWh	Energiya-9 ver. STK3	26711	0.2%	2007	September 2009	September 2015	
3	Electricity consumed by the new turbine №1	kWh	Energiya-9 ver. STK3	54809	0.2%	2012	12/04/2012	12/04/2018	16.05.12 this meter was installed instead of "Alpha A1140", serial number 05002024
4	Electricity generated by the new turbine № 2	kWh	Alpha A1800	01191079	1	2008	12/11/2008	12/11/2020	
5	Electricity consumed by the new turbine № 2	kWh	Energiya-9 ver. STK3	50111	0.2%	2012	10/07/2009	10/07/2015	
6	Electricity consumed by the new turbine № 2	kWh	Energiya-9 ver. STK3	11409	0.2%	2009	15/08/2007	15/08/2013	20.08.12 this meter was installed instead of "Energiya -9", serial number 19467
7	Input steam temperature in the new turbine № 2	ºC	ТНК-1-1	336	0.5%	2010	10/04/2012	10/04/2013	
8	Output steam temperature in the new turbine № 2	ºC	ТНК-1-1	2688	0.5%	2010	10/04/2012	10/04/2013	
9	Input steam pressure in the new turbine № 2	kPa	Metran 100	459619	0.5%	2010	08/05/2012	08/05/2013	
10	Output steam pressure in the new turbine № 2	kPa	Metran 100	460897	0.5%	2010	10/04/2012	10/04/2013	
11	Input flow of steam in the	t/h	Metran 100	173372	0.5%	2010	10/04/2012	10/04/2013	

Meter ID number	Parameter name	Units	Meter name	Serial number	Accuracy index	Date of installation	The last check date	The next check date	Notes
	new turbine № 2								
12	Output flow of steam in the new turbine № 2	t/h	Metran 100	412710	0.5%	2010	10/04/2012	10/04/2013	

Table 4: Equipment used for monitoring activities

B.1.3. Calibration procedures

The calibration interval for all types of electricity meters used at the plant is set by Ukrainian state committee for technical regulation and customer policy and does not exceed 6 years.

For the meters:

QA/QC procedures	The body responsible to calibration and certification
Maximum calibration interval for the Alpha A1140 meter is equal to 16 years	State company "Zaporozhstandartmetrologiya"
Maximum calibration interval for the Alpha A1800meter is equal to 12 years	State company "Zaporozhstandartmetrologiya"
Maximum calibration interval for the Energiya-9 meter is equal to 6 years	State company "Zaporozhstandartmetrologiya"
Maximum calibration interval for the THK-1-1 sensor is equal to 1 year	State company "Zaporozhstandartmetrologiya"
Maximum calibration interval for the Metran 100 sensor is equal to 1 year	State company "Zaporozhstandartmetrologiya"
Maximum calibration interval for the Metran 100 sensor is equal to 1 year	State company "Zaporozhstandartmetrologiya"

Table 5: Calibration procedure for project equipment

B.1.4. Involvement of Third Parties:

- Checking and calibration of meters is usually performed by state company "Zaporozhstandartmetrologiya";
- Certification: TUV Nord Cert. Gmbh;
- PJSC "Zaporozhsteklophlus" ;
- OJSC "MK "Zaporozhstal".

B.2. Data collection (accumulated data for the whole monitoring period):

Operational and management structure in accordance with Section D.3. in PDD:

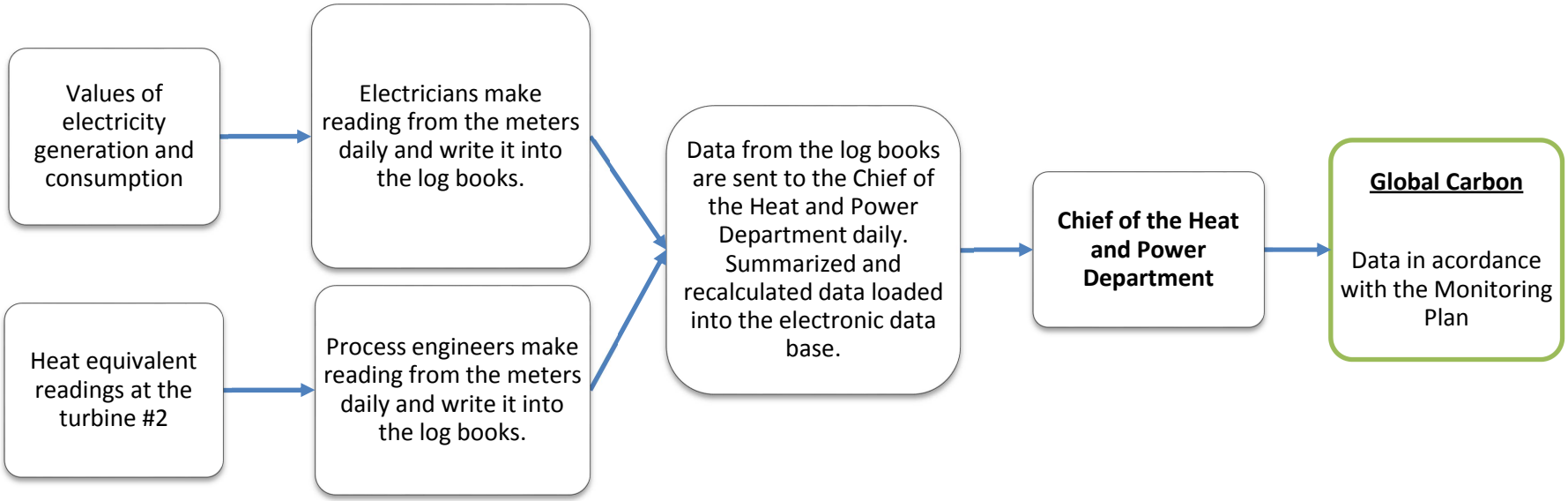

Figure 1: Data collection

B.2.1. List of fixed ex-post emission factors:

Data / Parameter	***Data unit***	***Description***	***Data Source***	***Value***	***Uncertainty level of data***
$EF_{grid,y}$	tCO_2/MWh	Specific CO_2 emission factor for power generation at Ukrainian grid connected thermal power plants in 2011 and after	Order of the National Environmental Investment Agency of Ukraine № 75 from 12.05.2011	1.063	Low
$k^c{}_{NG,y}$	tC/TJ	Carbon content for natural gas	National Inventory Report of Ukraine 1990-2010, p. 470 (value for stationary combustion, heat and power generation)	15.17	Low
$OXID_{NG,y}$	ratio	Carbon oxidation factor for natural gas	National Inventory Report of Ukraine 1990-2010, p. 471 (value for stationary combustion, heat and power generation)	0.995	Low

Table 6: Fixed parameters

Data/Parameter	$EF_{grid,y}$
Data unit	$kgCO_2/kWh = tCO_2/MWh$
Description	Specific CO_2 emission factor for power generation at Ukrainian grid connected thermal power plants
Time of determination/monitoring	Ex-post according to the publicly available data
Source of data (to be) used	For 2011: http://www.neia.gov.ua/nature/doccatalog/document?id=127498 For 2012: http://www.neia.gov.ua/nature/doccatalog/document?id=127498
Value of data applied	1.063 (for 2011) 1.063 (for 2012)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This emission factors for Ukrainian electricity grid approved by the DFP of Ukraine.
QA/QC procedures (to be) applied	Check on the updates of the emission factor.
Any comment	In case this value is not available the most recent available value will be used instead

B.2.2. List of variables:

Baseline emissions variables to be monitored:

ID (from PDD)	Parameter	Calculation method (Measured/Calculated/Estimated)	Unit	Comment	Meters used (as per B.1.2)	Data aggregation frequency
D.1.2.1.-1	$EG_{CHP,\Pr,y}$ Electricity generated under the project activity	(M)This value is obtained by direct measurement of electricity by the meter	kWh	The data will be archived and kept for two years after the last transfer of ERUs from the project.	1, 4	Data are aggregated monthly and annual reports are prepared
D.1.2.1.-2	$EC_{equip,\Pr,y}$ Electricity consumed by the project equipment	(M)This value is obtained by direct measurement of electricity by the meter	kWh	The data will be archived and kept for two years after the last transfer of ERUs from the project.	2, 3, 5, 6	Data are aggregated monthly and annual reports are prepared
D.1.3.1.-3	SG_{input} Heat equivalent of steam at the input of condensing turbine №2	(M/C)This value is obtained by automatically recalculating the values of temperature, flow and pressure of steam in heat equivalent of steam through Automatic system for technological process control (ASTPC)	GJ[4]	The data will be archived and kept for two years after the last transfer of ERUs from the project.	7,9,11	Data are aggregated monthly and annual reports are prepared
D.1.3.1.-4	SG_{output} Heat equivalent of steam at the output of condensing turbine № 2	(M/C)This value is obtained by automatically recalculating the values of temperature, flow and pressure of steam in heat equivalent of steam through Automatic system for technological process control (ASTPC)	GJ	The data will be archived and kept for two years after the last transfer of ERUs from the project.	8,10,12	Data are aggregated monthly and annual reports are prepared

[4] In the internal company technical reports this value amount is presented in Gcal. To convert this value into the GJ the following correlation is used: 1 Gcal = 4.1868GJ – data source http://ru.wikipedia.org/wiki/Калория and scientific manual - Vukalovic MP, Rivkin S.L., Alexandrov A.A.Tables of thermophysical properties of water and steam. M. Publisher 1969 standards – 408, p.49.

-	$k^{c}_{NG,y}$ - Carbon content for natural gas	(C) National Inventory Report of Ukraine (value for stationary combustion, heat and power generation)	tC/TJ	The data will be archived and kept for two years after the last transfer of ERUs from the project.	-	Ex-post data are presented by DFP of Ukraine on annually basis
-	$OXID_{NG,y}$ - Carbon oxidation factor for natural gas	(C) National Inventory Report of Ukraine (value for stationary combustion, heat and power generation)	ratio.	The data will be archived and kept for two years after the last transfer of ERUs from the project.	-	Ex-post data are presented by DFP of Ukraine on annually basis

Table 7: Monitored baseline emissions variables

B.2.3. Data concerning GHG emissions by sources of the project activity:

Not applicable.

B.2.4.Data concerning GHG emissions by sources of the baseline:

Variable	Description	Units	Period		
			2011*	2012**	Total
$EG_{CHP,\Pr,y}$	Electricity generated under the project activity	kWh	72432513	66086767	138519280
$EC_{equip,\Pr,y}$	Electricity consumed by the project equipment	kWh	3096000	2885783	5981783
SG_{input}	Heat equivalent of steam at the input of condensing turbine № 2	GJ	538753	499298	1038051
SG_{output}	Heat equivalent of steam at the output of condensing turbine №2	GJ	0	0	0

Table 8: Data that were collected in the baseline scenario

* Period from 01.04.2011 till 31.12.2011. Hereinafter in this report in tables values for 2011 are referring to this period

** Period from 01.01.2012 till 31.08.2012. Hereinafter in this report in tables values for 2012 are referring to this period

B.2.5.Data concerning leakage:

In accordance with the PDD the only leakage that takes place is the additional consumption of fuel at site of the external consumers, to cover the lack of COG which had been delivered, and now is used for condensing turbine. Formulas which describe these leakages are given in PDD, please see formulas B.1.6 – B.1.11.

Due to the principles of work of condensing turbine, there is a difference between steam input and steam output amounts. This difference describes the lack of fuel due to the leakages and is calculated the following way:

$$Lack_{fuel,i,y} = SG_{input} - SG_{output} \text{ , where} \qquad \text{(Equation 1),}$$

$Lack_{fuel,i,y}$ - Difference between heat equivalents of steam input and steam output amounts, in the monitoring period y, GJ;

SG_{input} - Heat equivalent of steam before the condensing turbine, GJ;

SG_{output} - Heat equivalent of steam after the condensing turbine, GJ;

Leakages due to extra natural gas combustion at site of external consumers are calculated using following formula (in accordance with formula B.1.4):

$$LE_{CHP,y} = \frac{Lack_{fuel,i,y} \times EF_{NG}}{1000}$$, where (Equation 2),

EF_{NG} - Emission factor for natural gas. This parameter is calculated on the carbon content and carbon oxidation from National Inventory Report of Ukraine 1990-2010, kg CO_2/GJ;

1000 - Conversion factor to convert kg CO_2 in tCO_2;

y – Monitoring period.

$$EF_{NG} = k^{c}{}_{NG,y} \cdot OXID_{NG,y} \cdot \frac{44}{12}$$, where (Equation 3),

$k^{c}{}_{NG,y}$ - Carbon content for natural gas, tC/TJ;

$OXID_{NG,y}$ - Carbon oxidation factor, ratio;

$\frac{44}{12}$ - Ration between molecular mass of CO_2 and C. Reflect oxidation of C to CO_2.

ID (from PDD)	Parameter	Calculation method (Measured/Calculated/Estimated)	Unit	Comment	Meters used (as per B.1.2)	Data aggregation frequency
D.1.3.1.-3	SG_{input} Heat equivalent of steam at the input of condensing turbine №2	This value is obtained by automatically recalculating the values of temperature, flow and pressure of steam in heat equivalent of steam through Automatic system for technological process control (ASTPC)	GJ[5]	The data will be archived and kept for two years after the last transfer of ERUs from the project.	7,9,11	Data are aggregated monthly and annual reports are prepared

[5] In the internal company technical reports this value amount is presented in Gcal. To convert this value into the GJ the following correlation is used: 1 Gcal = 4.1868GJ – data source http://ru.wikipedia.org/wiki/Калория and scientific manual - Vukalovic MP, Rivkin S.L., Alexandrov A.A.Tables of thermophysical properties of water and steam. M. Publisher 1969 standards – 408, p.49.

D.1.3.1.-4	SG_{output} Heat equivalent of steam at the output of condensing turbine № 2	(M/C)This value is obtained by automatically recalculating the values of temperature, flow and pressure of steam in heat equivalent of steam through Automatic system for technological process control (ASTPC)	GJ	The data will be archived and kept for two years after the last transfer of ERUs from the project.	8,10,12	Data are aggregated monthly and annual reports are prepared
-	$k^{c}_{NG,y}$ - Carbon content for natural gas	(C) National Inventory Report of Ukraine (value for stationary combustion, heat and power generation)	tC/TJ	The data will be archived and kept for two years after the last transfer of ERUs from the project.	-	Ex-post data are presented by DFP of Ukraine on annually basis
-	$OXID_{NG,y}$ - Carbon oxidation factor for natural gas	(C) National Inventory Report of Ukraine (value for stationary combustion, heat and power generation)	ratio.	The data will be archived and kept for two years after the last transfer of ERUs from the project.	-	Ex-post data are presented by DFP of Ukraine on annually basis

Table 9: Data that were collected for leakage calculation

External users of coke oven gas in the reporting monitoring period were:

- PJSC "Zaporozhsteklophlus" with accordance to agreements №1712 dated 01/09/2010 and №2356 dated 01/09/2011.
- OJSC "MK "Zaporozhstal" with accordance to agreement №1258 dated 01/06/2012.

B.2.6.Data concerning environmental impacts:

Proposed project foresees the increase of COG combustion efficiency and, therefore, will improve the environmental conditions in the region. Proposed project does not create additional sources of emissions but is considered to be a reason of some additional negative effects, such as noise and vibration. These effects negatively influence working conditions of the staff. Certification of jobs held once every 5 years according to the procedure for attestation of working places on working conditions. As a result of these measurements the working condition cards for relevant workplaces are issued. Last certification was at 2008 year. To investigate this influence the district sanitation and epidemiological service (SES) makes the measurement periodically. If some parameters exceed the nominal permitted level, it is required to use means of individual protection by staff.

The following working condition cards were issued for turbine shop:

- Card No 30-11 "Head of turbine shop";

- Card No 30-08 "Turbine operator";
- Card No 30-09 "Turbine operator/man-on-foot"

B.3.Data processing and archiving (incl. software used):

In normal regime the instant data concerning generation/consumption of electricity is displayed on the LCD display of electricity meters in cyclical order (in succession, one by one) with holding time equal to 6-8 sec.

Measurement data are registered by PCS (process control system). Electricity generation level measures by the PCS (feeder 114 "generator 1" and feeder 12 "generator 1" in the database of «Alpha CENTER[6]» software. Also log book is used to register these values manually as well as values concerning electricity consumption by project equipment.

During the process of collecting the data from the meter "Alpha CENTER" software makes the following calculations:

- Converting the interval values read from the meters (telemetric pulses) into the named (physical) units of electricity (kWh);
- Calculation of interval rate of electricity (in kWh).

All data achieved by "Alpha CENTER" software are collected and archived in the data base. There exists an IT department to proceed general maintenance of the IT equipment used on the plant. Monthly all data go through the archiving and backup procedures. This activity takes place with help of special organization "TRAFIC" which has a relevant contract with "ZaporozhCox". "TRAFIC" company is also responsible for adjusting and correcting of the "Alpha CENTER" software on demand of ZaporoxhCox.

Accounting of electricity consumption for own needs is metered by four meters (Energiya-9 and Alfa1140) installed on the feeders №1, №9, №15, №16. In normal regime these meters work in parallel, and their readings are summarized to get a total value.

In the frame of QMS (Quality Management System) ISO 9001 implemented at "ZaporozhCox", the report "Report of the processes performance" is developed on monthly base. Among the parameter of this report is "Provision electricity generated onsite". Therefore, data for the electricity production by the turbine are subject to internal auditing under ISO 9001.
Department of Chief Power Engineer provides all necessary data to the working group by filling in the form 8.2.ZK01 "Measurement of the QMS processes". Monthly reports are composed on the base of this form are transferred to the First Deputy General Director for revision. This procedure named "Analysis from the managing party". If some parameters are considered as not satisfactory, the correction is prescribed under the procedure 8.5.2.ZK01 "Correction and preventative actions". Annual reports which are based on the monthly reports are saved for at least 3 years.

B.4. Special event log:

Next special events have taken place during monitoring period:

[6] Complex "Alpha CENTER" for measurement and calculations designed to measure electricity and power, as well as automatic collection, processing and storing collected information. The complex includes communication server, communication modules, installation DB core, modules of controlling system, client's software (screen forms, diagrams, reports). For more information see http://www.alphacenter.ru .

- Electricity meter "Energiya-9" ver. STK3 #54809 was installed instead of electricity meter "Alpha A1140", serial number 05002024 on May 16, 2012. This change has taken place because of malfunction of previous meter.

- Electricity meter "Energiya-9" ver. STK3 #11409 was installed instead of electricity meter "Energiya-9", serial number 19467 on August 20, 2012. This change has taken place because of malfunction of previous meter.

Other events did not occur more.

SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

In the framework of this project electricians and process engineers are responsible for the data registration from the relevant meters.
Electricians are responsible for the data registration from the electricity meters.

Process engineers are responsible for the data registration from the ASTPC.

Duty of Chief of the Heat and Power Department in the framework of this project lies in data processing and preparation of reports which are the main source for Monitoring Reports.

C.1.2. Trainings:

Existing staff got used for working in the turbine workshop after the relevant education provided in case of lack of qualification. Education was provided by equipment producers and specialized organizations:

- PJSC "Zaporozhcox" with accordance to license №586179 dated 11/08/2011;
- TUV Nord Cert. Gmbh with accordance to agreement №1100203211/109/ dated 20/04/2011.

C.2. Involvement of Third Parties:

External users of coke oven gas in the reporting monitoring period were:

- PJSC "Zaporozhsteklophlus" with accordance to agreements №1712 dated 01/09/2010 and №2356 dated 01/09/2011;
- OJSC "MK "Zaporozhstal" with accordance to agreement №1258 dated 01/06/2012.

Organizations which is providing metrological and training services:

- SE "Zaporozhstandartmetrologiya" with accordance with accordance to agreement №190m-2012/38 dated 23/12/2011.

C.3. Internal audits and control measures:

Data relevant to the emission reduction calculation are registered daily in the log books. During the operation, there are minor variations in the electricity generation level that are observed. Therefore, any measurement error is easily identified, in case of values that significantly differ from the common (in case of equal conditions) are received.

Independently data is submitted and processed in the manufacturing department and the heat and power department. These units submit the results to the department of planning. In case of differences data is checked and found out the cause.

At the enterprise PJSC "Zaporozhkoks" internal integrated management system is introduced, which conducts an audit of divisions in compliance with the standards ISO 9001:2008, ISO 14001and OHSAS 18001. The purpose of such verification is the detection and correction of violations and inconsistencies in the workplace.

During the monitoring period the following internal audits of boiler and turbine plant were conducted:

- Report No. 24 from 29/07/2011on the internal audit of boiler-turbine plant;

- Report No. 24 from 17/07/2012 on the internal audit of boiler-turbine.

As a result of conducted inspections, no mistakes on the project were detected.

Further a protocol on compliance is made and measures on corrections of the plant activity are held in compliance with the standards ISO 9001, ISO 14001 and OHSAS 18001.

Besides, security checks of workplace are held, and all comments and corrections are contained in the map of behavioural safety audit.

The integrated management system, which is introduced in the enterprise, allows optimizing the functional activity of divisions, as well as avoiding future violations. In addition, the safety of work in the shops with increased danger is provided.

C.4. Troubleshooting procedures:

In case of failure of any equipment which leads to impossibility to generate electricity, the turbine will be stopped until the malfunction is fixed. The turbines' work is under control of modern automatic systems. Any variation in electricity generation level will be registered by relevant meters.

If the main metering device fails, and there is no reserve metering device available, the monitoring report will use indirect data and evidence, but only if their applicability (data and evidence) is justifiably proven. Likely, a conservative approach will be used.

SECTION D. Calculation of GHG emission reductions

D.1. Tables of formulas used:

Formula number from PDD	Formula	Formula description
(D.1.1)	$BE_y = EG_{net,\Pr,y} \times EF_{grid,y}$	Baseline emissions calculation
(D.1.2)	$EG_{net,\Pr,y} = EG_{CHP,\Pr,y} - EC_{equip,\Pr,y}$	Calculation of the net amount of electricity in the year *y*, generated by turbines under the project activity
(D.1.3)	$Lack_{fuel,i,y} = SG_{input} - SG_{output}$	Calculation of difference between steam input and steam output amounts
(D.1.4)	$LE_{CHP,y} = \frac{Lack_{fuel,i,y} \times EF_{NG}}{1000}$	Calculation of leakages due to extra natural gas combustion at site of external consumers
(D.1.5)	$ER_y = BE_y - LE_{CHP,y}$	Calculation of emission reductions

Table 10: Calculation formulas

Results of the emissions calculations above are presented in metric tons of carbon dioxide equivalent (t CO_2 equivalent). The metric ton of carbon dioxide equivalent is equal to the metric ton of carbon dioxide (tCO_2). Therefore 1 t CO_2 equivalent = 1 t CO_2.

D.2. Description and justification of the uncertainties of measurements:

Accuracy index of all meters used allows making measurements with sufficient level of uncertainty.

D.3. GHG emissions reduction (in accordance with Section B.2 of this document):

D.3.1. Project emissions:

In accordance with PDD there are no project emissions.

D.3.2. Baseline emissions:

Baseline Emissions are calculated by the following formulas:

$$BE_y = EG_{net,\Pr,y} \times EF_{grid,y} \quad \text{(Equation 4)},$$

BE_y - Baseline emissions in the year *y* due to grid electricity consumption, t CO_2 equivalent;

$EG_{net,\Pr,y}$ - Net amount of electricity in the year *y*, generated by turbines under the project activity (without electricity consumed by the project equipment), kWh.

$EF_{grid,y}$ - Emission factor for the electricity consumption from the grid in the monitoring period *y*.

$$EG_{net,\Pr,y} = EG_{CHP,\Pr,y} - EC_{equip,\Pr,y} \quad \text{(Equation 5)},$$

$EG_{CHP,\Pr,y}$ - Amount of electricity in the year *y*, generated by turbines under the project activity, kWh;

$EC_{equip,\Pr,y}$ - Amount of electricity consumed by equipment in the monitoring period *y*, installed under the project activity, kWh.

Parameter	Unit	**2011**	**2012**	**Total**
Baseline emissions	tonnes of CO_2 equivalent	73705	67183	140888

Table 11: Baseline emissions

D.3.3. Leakage:

In accordance with the PDD the only leakage that takes place is the additional consumption of fuel at site of the external consumers, to cover the lack of COG supplied due to the principle of work of condensing turbine. In accordance with technical report turbine №2 was working in condensing mode of heating without selection during all monitoring period.

Parameter	Unit	**2011**	**2012**	**Total**
Leakages	tonnes of CO_2 equivalent	29817	27634	57451

Table 12: Leakage

D.3.4. Summary of the emissions reductions during the monitoring period:

The annual emission reductions are calculated as follows:

$$ER_y = BE_y - LE_{CHP,y} \qquad \text{(Equation 6)},$$

ER_y - The annual emission reductions, t CO_2 equivalent;

BE_y - Baseline emissions in the monitoring period *y* due to grid electricity consumption, t CO_2 equivalent;

$LE_{CHP,y}$ - Leakages due to the project realization in the monitoring period *y*, t CO_2 equivalent.

Parameter	Unit	**2011**	**2012**	**Total**
Emission reductions	tonnes of CO_2 equivalent	43888	39549	83437

Table 13: Emission reductions

Annex 1

Definitions and acronyms

Abbreviations and acronyms:

COG	Coke oven gas
CO_2	Carbon Dioxide
GHG	Greenhouse gases
IPCC	Intergovernmental panel on climate change
PDD	Project design document
ERU	Emission reduction units

Definitions:

Baseline	The scenario that reasonably represents what would have happened to greenhouse gases in the absence of the proposed project, and covers emissions from all gases, sectors and source categories listed in Annex A of the Protocol and anthropogenic Removals by sinks, within the project boundary.
Emissions reductions	Emissions reductions generated by a JI project that have not undergone a verification or determination process as specified under the JI guidelines, but are contracted for purchase.
Greenhouse gas (GHG)	A gas that contributes to climate change. The greenhouse gases included in the Kyoto Protocol are: carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorcarbons (HFCs), Perfluorcarbons (PFCs) and Sulphurhexafluoride (SF_6).
Joint Implementation (JI)	Mechanism established under Article 6 of the Kyoto Protocol. JI provides Annex I countries or their companies the ability to jointly implement greenhouse gas emissions reduction or sequestration projects that generate Emissions Reduction Units.
Monitoring plan	Plan describing how monitoring of emission reductions will be undertaken. The monitoring plan forms a part of the Project Design Document (PDD).