SECOND PERIODIC JI MONITORING REPORT

Version 3.0
28 March 2011

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SECTION A. General Project activity information

A.1 Title of the project activity:

"Utilization of surplus coke oven gas with the electricity generation at JSC "Yasynivskyi Coke Plant".

A.2. JI registration number:

Project registration number is: UA1000185.

A.3. Short description of the project activity:

The aim of the project is to ensure more full utilization of energy resources of the enterprise and obtaining self-produced electricity. After introduction of coke oven batteries №1 and № 4 the plant will produce the surplus coke oven gas, which under conditions of project absence (utilization and waste electricity), will be flared. Under the project conditions, the surplus coke oven gas is burnt in the boilers and obtained steam will generate electricity. Data about amount of electric energy, produced within the framework of the project, which would have been generated by Ukrainian Energy System power stations using fossil fuels without project activity implementation, are provided in Table 1.

Table 1. Amount of electricity produced in consequence of the utilization of surplus coke oven gas

Period	**Electricity generated, *MWh***
1.01.2010-31.12.2010	65 469,14
Total 2010	**65 469,14**

A.4. Monitoring period:

• Monitoring period starting date: 01.01.2010;
• Monitoring period closing date: 31.12.2010.
Start day and end day are included.

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

A.5.1. Baseline methodology: The approved consolidated methodology ACM0012/ Version 03.1 (dated 28.11.2008) "Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects" has been used to identify the baseline scenario of the proposed JI project. This methodology also refers to the "Tool for the demonstration and assessment of additionality" Version 05.2 (dated 26.08.2008).

A.5.2. Monitoring methodology: The approved consolidated methodology ACM0012/ Version 03.1 (dated 28.11.2008) "Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects" has been used to monitor the proposed JI project.

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

Table 2. Status of implementation (according to PDD version 4)

Activity	**Date**
Beginning of the project investment stage	2004
Launch of: - reconstructed coke oven battery №1, - installed first PT-12 turbogenerator	2006
Launch of:	2012

- reconstructed coke oven battery №4, - installed additional steam boiler BK-50, - installed second PT-12 turbogenerator	

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

There are no deviations to the determined PDD.

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

There are no deviations to the determined monitoring plan.

A.9. Changes since last verification:

There are no changes since last verification.

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

PJSC "Yasynivskyi Coke Plant":

- Alexander Sevastianov, Vice-chief of heat and power sector of the plant.

Environmental (Green) Investments Fund LTD:

- Sergiy Skybyk, Inventory and project expert (Energy sector).

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

Key monitoring activities could be described as follows.

Accounting of energy production

Reading of meters for the produced energy is conducted on unit-to-unit basis every 12 hours and is entered into the log book. The data is aggregated into the monthly and annual reports and is stored in paper and electronic formats.

Data collection is carried out by a *shift caretaker of the Main control board*. The responsible person for the collection and archiving of the data is the *head of the electricity area*. Monitoring scheme for electrical power generation is attached in Annex 1.

Meters check is conducted according to the verification methodology certified by the Ukrainian state scientific-production center for standardization, metrology and certification (UkrCSM). The Electotechnical laboratory of the enterprise is responsible for meeting the meters checks deadlines.

The amount of electricity consumed for the PT-12 own needs is determined by monthly calculations in consideration of the working auxiliary equipment load factor, as well as its capacity. The data is archived and stored in paper and electronic formats. The responsible person for the collection and archiving of the data is the *head of the electricity area*.

Accounting of coal consumption of CHP boilers

The amount of coal, consumed by the boilers, is determined when coal is supplied to the CHP by using the electro-mechanical scales. The parameters of the scales are cited in Table 4. Data on the amount of coal is entered into the logbook. The responsible person is the *head of the production department*.

The net caloric value of coal supplied to the CHP and combusted in the boilers is determined according to the technical specifications У 10.1-23472138-161:2005 for coal sort G, belonging to which was established by state enterprise "Luganskstandartmetrology".

Accounting of the coke oven gas consumption in CHP boilers

Accounting of the coke oven gas consumption in CHP is determined by the meter on gas-flow inlet to the boiler house (pie chart). The pie chart readings is conducted manually every 24 hours by *shift caretaker of Control, Measurement and Automation department*, reduced to the normal conditions (readings of the gas temperature are also performed manually from the similar diagram) and entered into logbooks and electronic data base. The responsible person for the collection and archiving of the data is the *head of Control, Measurement and Automation department*.

The meter's specs are cited in Table 5.

Coke oven gas NCV is determined monthly by the Central plant laboratory. The results are entered into the logbook.

B.1. Monitoring equipment types

1. Electricity meters "SAZU-I 687"
2. Electricity meters "Indigo+"
3. Electro mechanical railway carriage scales "VV-150E-1"
4. Coke oven gas flow meter "KSD-3", modification 1010
5. Coke oven gas temperature meter "KSMz-P"

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):

The control and monitoring system may be divided into an electrical part, a coke oven gas part and a coal weight part.

Electrical measurements

For the purpose of monitoring the emission reductions the following parameters are measured:

- Energy generation by the AR-6 generator 1 after project activity implementation;
- Energy generation by the AR-6 generator 2 after project activity implementation;
- Energy generation by the PT-12 generator 1 after project activity implementation.

Table 3. List of electric meters

ID of the meter	Measuring parameter	Work parameter	Type	Serial number	Grade of accuracy	Year of production	Date of instal-lation	Data of last calibration	Data of next calibration	Remarks
EL1	Amount of electricity generated by AR-6-1	*MWh*	SAZU-I 687	278124	1,0	1983	1983	1-st quarter 2009	1-st quarter 2013	3x100V, 1kWh=1000 impulses (Disk rotations) Technical conditions 25.01.838-77
EL2	Amount of electricity generated by AR-6-2	*MWh*	SAZU-I 687	278116	1,0	1983	1983	1-st quarter 2009	1-st quarter 2013	3x100V, 1kWh =1000 impulses (Disk rotations) Technical conditions 25.01.838-77
EL3	Amount of electricity generated by PT-12	*MWh*	Indigo+	UA015673	0,5	2003	2006	4-st quarter 2005	4-st quarter 2011	Electronic impulse meter registered in the State registry , position # У1113-01

Coal weight measurements

For the purpose of monitoring the emission reductions the following parameters are measured:

- Amount of coal consumed by CHP after project activity implementation.

Table 4. List of weighting machines

ID of the meter	Measuring parameter	Work parameter	Type	Serial number	Grade of accuracy	Year of production	Date of instal-lation	Data of last calibration	Data of next calibration	Remarks
W1	Amount of coal consumed CHP	*ths. tons*	Electro mechanical railway carriage scales VV-150E-1	028 (004) ж/д	According to State standart GOST 2932 – average (III)	2000	07.09.2001	21.09.10	21.03.11	Verification scale factor – 50 kilograms, number of graduation marks – 3000

Coke oven gas measurements

For the purpose of monitoring surplus coke oven gas consumption the following parameters are measured:

- Amount of coke oven gas consumed by CHP after project activity implementation;
- Temperature of coke oven gas consumed by CHP (for recalculation the amount of consumed coke oven gas to normal conditions).

Table 5. List of coke oven gas meters

ID of the meter	Measuring parameter	Work parameter	Type	Serial number	Grade of accuracy	Year of production	Date of instal-lation	Data of last calibration	Data of next calibration	Remarks
CC1	Amount of coke oven gas consumed by CHP	*mln. m^3*	Coke oven gas flow meter "KSD-3", modification 1010	299048	1,5	1980	1980	23.06.10	23.06.11	GOST 19610-74
CC2	Temperature of coke oven gas consumed by CHP	ºC	Coke oven gas temperature meter "KSMz-P"	368319	0,5	1984	1984	23.06.10	23.06.11	This meter's data is used for recalculation the amount of consumed coke oven gas to normal conditions

B.1.3. Calibration procedures

For electricity meters

QA/QC procedures	Body responsible for calibration and certification
Calibration interval is 4 years for the SAZU type meters and 6 years for the Indigo+ meters.	Ukrainian Centre for Standardization and Metrology. The Electotechnical laboratory of the enterprise is responsible for meeting the meters checks deadlines.

For weighting machines

QA/QC procedures	Body responsible for calibration and certification
Calibration interval of such meters is 6 months.	Ukrainian Centre for Standardization and Metrology. (Donetsk center for standardization, metrology and certification, Makeevskiy branch)

For coke oven gas meters

QA/QC procedures	Body responsible for calibration and certification
Calibration interval is 1 year for the KSD and KSM type meters.	Ukrainian Centre for Standardization and Metrology. (Donetsk center for standardization, metrology and certification, Makeevskiy branch)

B.1.4. Involvement of Third Parties:

- Ukrainian Centre for Standardization and Metrology[1].
- Donetsk center for standardization, metrology and certification (Makeevskiy branch), a is a subsidiary of the "Ukrainian Centre for Standardization and Metrology", has been involved for the regular calibration of the weighting machines and coke oven gas meters.

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

For the operational and management structure of the project see PDD section D.3. Data collection process is described above (please see section B of the Monitoring report).

[1] All measurement equipment should be calibrated according to terms and methodology defined by this centre requirements.

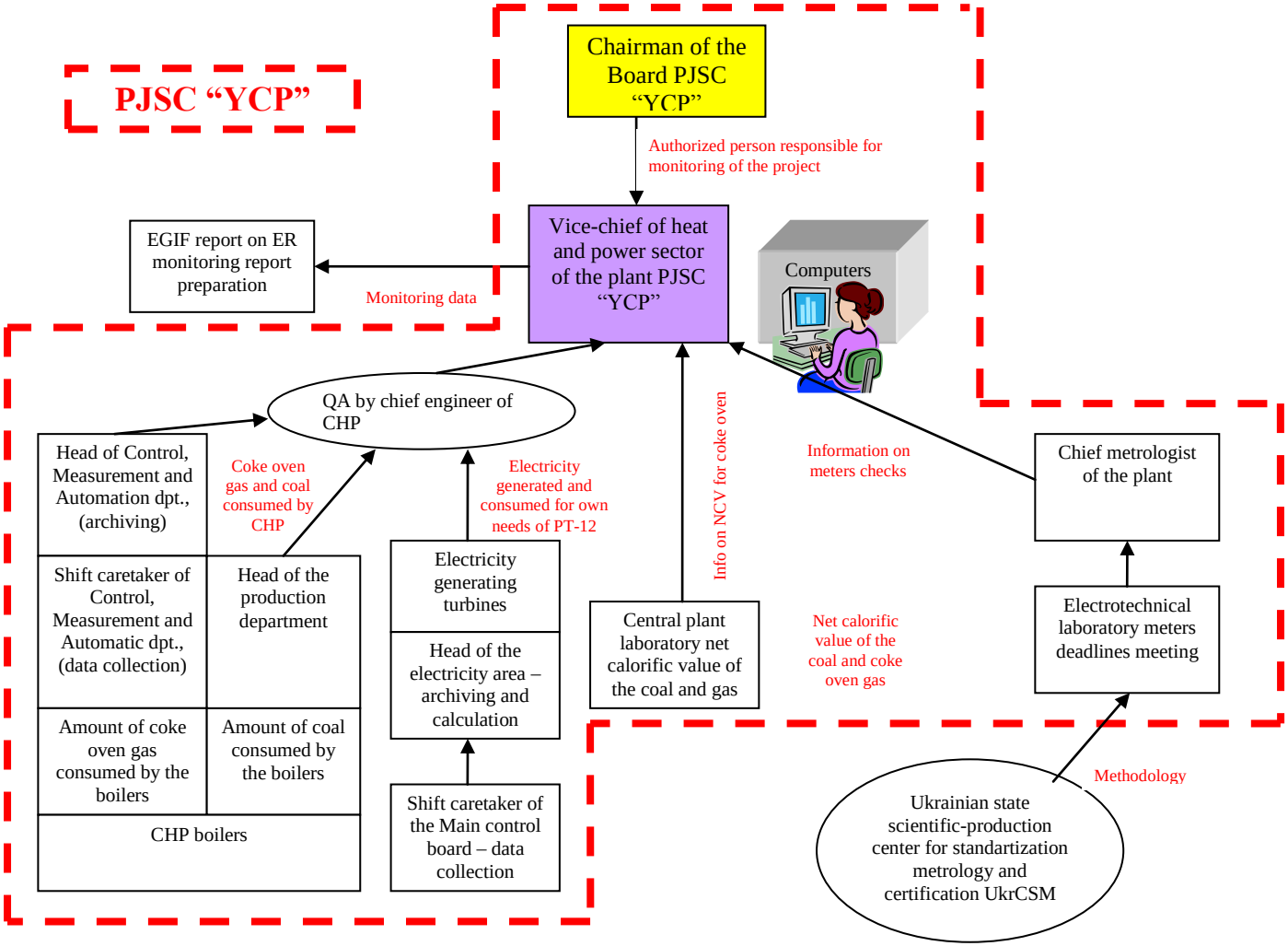

Figure 1: *Organizational chart of project monitoring*

B.2.1. List of fixed default values:

CO_2 emission factor for the Ukrainian energy system is determined according to the existing published studies, as it was stated in the monitoring plan provided in the PDD (see section D.1.3).

In order to establish a unified approach to specific carbon dioxide emissions calculation resulting from electricity generation by thermal power plants and its consumption an appropriate calculation Methodology[2] was approved by Decree #39 of the National Environmental Investment Agency from March 21, 2011.
According to this methodology calculation of specific carbon dioxide emissions from electricity generation and consumption is based on the following data:
- electricity amount released by the thermal power plant;
- fuel consumption for released electricity;
- fuel net calorific value;
- heat losses from chemical and mechanical combustion incompleteness;
- technological electricity losses in electricity grids.

The approach for calculation of specific carbon dioxide emissions from electricity generation by an indicated group of thermal power plants connected to the electricity system of Ukraine, provided in the Methodology, corresponds to the option A1 for calculation of the operating margin emission factor $EF_{grid,OMsimple,y}$, according to the methodological tool "Tool to calculate the emission factor for an electricity system", version 02, approved by the CDM Executive Board, United Nations Framework Convention on Climate Change.

Decree #43 of the National Environmental Investment Agency from March 28, 2011 sets specific carbon dioxide emissions values for 2010 electricity generation by thermal power plants connected to the electricity system of Ukraine, which was calculated and approved in accordance with the Methodology. Pursuant to this Decree the value was set at 1,067 kg CO_2/kWh and recommended for applying during annual monitoring reports preparation.

For monitoring report EF applicable for supply-side projects was applied for the reasons that were described in PDD (please see section B.2 of PDD, version 4). The special feature of the electricity supply scheme at PJSC «YCP» is that the enterprise has to supply a part of project-generated energy to the grid, wherefrom it is delivered to consumers of PJSC «YCP» via power step down transformer. The conservative baseline suggests that all the electricity produced due to the project activity is supplied to the grid. To calculate emissions reduction it is necessary to use emissions factor which is defined for energy displacement in the National Energy System of Ukraine for the energy, produced during the project activity.

The emission factor value set for 2010 in accordance with the Methodology for specific carbon dioxide emissions calculation from electricity generation by thermal power plants and its consumption is higher than the emission factor value used for calculation of expected emissions reduction in PDD. Thus amount of emission reductions reached in 2010 is higher than it was planned during PDD preparation.

[2] Methodology for specific carbon dioxide emissions calculation from electricity generation by thermal power plants and its consumption approved by Decree #39 of the National Environmental Investment Agency from March 21, 2011.

Table 6. List of ex-ante fixed values

Data variable	Source of data	Data unit	Comment
$EF_{CO2,1}$ CO_2 emission factor for coal combusted additionally with coke oven gas after project activity implementation	26,8 *t C/TJ* according to the National GHG Inventory Report of Ukraine, 1990-2007 (Annex 2, section A2.5, page 271)	tCO_{2eq}/ *TJ*	After emission factor recalculation from *t C/TJ* to *t* CO_2*/TJ:* 98,27 *t* CO_2*/TJ*
$EF_{Elec,produc}$ CO_2 emission factor for electricity generation by a thermal power plants connected to the electricity system of Ukraine	Approved by NEIA's Decree #43 as of 28, 2011	tCO_{2eq}*/MWh*	Set value 1,067 *kg* CO_2*/kWh* that equals to 1,067 tCO_2*/MWh*

Table 7. Baseline fixed values

Data variable	Source of data	Data unit	Comment
$EG_{captive,B}$ maximum electricity production by AR-6 turbines during three years before the first PT-12 turbine was installed according to the project	See PDD Annex 2 (Table Ann.2.2. Amount of captive electricity generated on PJSC "YCP" CHP plant in 2003-2005, ths. kWh)	*MWh*	36 985 *MWh*
$FF_{A,i,BL}$ Average annual consumption of coal by heat generation plant boilers three years before project implementation	See PDD section D.1.1.2	*ths.tons*	1,419 *ths.tons*

B.2.2. List of variables:

The list of variables was defined in the PDD (Section D) in order to calculate emission reductions in a proper way. Some of variables could not be monitored directly, so data should be determined another way. The following table establishes the link between data from the meters and corresponding variables.

Table 8. List of variables monitored directly

Data variable	Data unit	Method of calculation	Meters used for calculation
$EG_{gen,1,y}$ Energy generation by the enterprise's AR-6 generator 1 after project activity implementation, in the year *y*	*MWh*	Measured by electric meter	EL1 (see Table 3)

$EG_{gen,2,y}$ Energy generation by the enterprise's AR-6 generator 2 after project activity implementation, in the year *y*	*MWh*	Measured by electric meter	EL2 (see Table 3)
$EG_{gen,3,y}$ Energy generation by the enterprise's PT-12 generator 1 after project activity implementation, in the year *y*	*MWh*	Measured by electric meter	EL3 (see Table 3)
$EG_{gen,4,y}$ Energy generation by the enterprise's PT-12 generator 2 after project activity implementation, in the year *y*	*MWh*	Not applicable for this monitoring period	$EG_{gen,4,y} = 0$
$FF_{A,i,y}$ Annual consumption of coal by CHP plant boilers after project implementation	*ths.tons*	Measured by weighting machine	W1 (see Table 4)
Q_{WCM} Quantity of coke oven gas used for energy generation by CHP plant boilers	*mln. m^3*	Measured by coke oven gas meter	CC1 (see table 5)

Table 9. List of variables not monitored directly

Data variable	**Source of data**	**Data unit**	**Comment**
NCV_i Net calorific value of coal combusted as supplementary fuel during project activity	The NCV of coal supplied to the CHP and combusted in the boilers is determined according to the technical specifications У 10.1-23472138-161:2005 for coal sort G, belonging to which was established by state enterprise "Luganskstandardmetrology"	*TJ/ths.tons*	20,272 *TJ/ths.tons*
NCV_{WCM} Net calorific value of surplus coke oven gas	Determined by plant's laboratory calorimeter	*TJ/mln.m3*	NCV_{WCM} (2010) = 19,73.
$EG_{own1,y}$ Energy consumption for own needs of PT-12 generator 1 which is installed according to project activity, in the	Calculated according to "Instruction on monitoring of the project "Utilization of surplus coke oven gas with the electricity generation at JSC "Yasynivskyi Coke Plant" dated 6.05.2006.	*MWh*	$EG_{own1\ (2010)}$ = 4666,16.

year *y*			
$EG_{own2,y}$ Energy consumption for own needs of PT-12 generator 2 which is installed according to project activity, in the year *y*	Calculated according to "Instruction on monitoring of the project "Utilization of surplus coke oven gas with the electricity generation at JSC "Yasynivskyi Coke Plant" dated 6.05.2006.	*MWh*	Not applicable for this monitoring period. $EG_{own2,y}$ = 0.

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

Directly monitored data (see Table 8) are collected to handwritten journals / electronically.

Table 10. Data collected in the project scenario

Variable	**Description**	**Unit**	**Value for the stated period**
			1.01.2010-31.12.2010
$FF_{A,i,y}$	Consumption of coal by CHP plant boilers after project implementation	*ths.tons*	1,508
Q_{WCM}	Quantity of coke oven gas used for energy generation by CHP plant boilers	*mln. m³*	235,398

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

Directly monitored data (see Table 8) are collected to handwritten journals / electronically.

Table 11. Data collected in the baseline scenario

Variable	**Description**	**Unit**	**Value for the stated period**
			1.01.2010-31.12.2010
$EG_{gen,1,y}$	Energy generation by the enterprise's AR-6 generator 1	*MWh*	28078,2
$EG_{gen,2,y}$	Energy generation by the enterprise's AR-6 generator 2	*MWh*	0,0
$EG_{gen,3,y}$	Energy generation by the enterprise's PT-12 generator 1	*MWh*	79042,1
$EG_{gen,4,y}$	Energy generation by the enterprise's PT-12 generator 2	*MWh*	0

B.2.5. Data concerning leakage:

PDD did not identify any leakage, therefore this section is not applicable.

B.2.6. Data concerning environmental impacts:

The project improved efficiency of use of coke oven gas at the enterprise and thus leaded to decrease of harmful emissions. Environmental Impact Statement by OJSC "DneprVNIPIenergoprom" for the PT-12 construction project was received.

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

Information from coke oven gas flow meters and electric meters is saved continuously. The archiving period for the log files is at least one year. Information about coal consumption is accounted when coal is supplied to the CHP stock and summarized in annual reports. All data are archived electronically in month and annual reports. Electronically archived data and handwritten journals will be stored until the end of crediting period plus two years, that was enjoined by the plant order №498 dated 14.08.2010. The *vice-chief of heat and power sector* of the plant is responsible for the keeping of the monitoring data.

B.4. Special event log:

There are no special events took place within the monitoring period.

SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

The general project management is implemented by the Chairman of the Board PJSC "YCP" through the appointment of the person responsible for the supervising and coordinating activities of the monitoring. For the considered monitoring period the *vice-chief of heat and power sector of the plant* is responsible for the carrying out of the monitoring. On-site day-to-day management is implemented by the *Head of Control, Measurement and Automation dpt.*, the *head of the electricity area* and the *head of the production department.* Data collection is carried out by *shift caretakers* (operators). The facility is in 24 hours operation. Three shifts by eight hours have been introduced. The *chief metrologist of the plant* is responsible for the timely conduction of the scheduled meters calibration. The *head of the Central plant laboratory* is responsible for the regular coke oven gas NCV determination.

All data necessary for the CO2 emission reductions calculation are collected by the *vice-chief of heat and power sector of the plant* and forwarded to the Environmental (Green) Investments Fund ltd. The specialists of the fund are making calculations on a monitoring period duration basis.

For this monitoring period (in line with the plant order №491 dated 14.07.2010) the names of the involved personnel are as follows:

- Vice-chief of heat and power sector of the plant: Alexander Sevastianov
- Head of Control, Measurement and Automation dpt.: Maxim Rusanov
- Head of the electricity area: Dmitry Bogdanov
- Head of the production dpt.: Alexey Shevchenko
- Chief metrologist of the plant: Larisa Krivaya
- The *head of the Central plant laboratory*: E.Okhrimenko

C.1.2. Trainings:

After installation of project turbogenerator PT-12, CHP staff underwent training at the manufacturer of the turbines (Kaluga turbine works). Also, employees of the metrological service of PJSC «Yasynivskyi Coke Plant» were passed through Refresher trainings. Education was held in Kievan Research and Training Centre of Standardization, Certification and Quality of Gospotrebstandart of Ukraine (please see PDD section D.3). At the PJSC "YCP" for the personnel of the plant periodically are conducting inner refresher trainings "Terms of design and safe operation of pressure vessels" and "Electrical and work technology fundamentals".

C.2. Involvement of Third Parties:

Donetsk center for standartization, metrology and certification (Makeevskiy branch) is a subsidiary of the "Ukrainian Centre for Standardization and Metrology", has been involved for the regular calibration of the weighting machines and coke oven gas meters.

C.3. Internal audits and control measures:

At PJSC "Yasynivskyi Coke Plant" was introduced and applied a quality management system ISO 9001:2008. This fact is evidenced by a certificate issued by TÜV Thüringen e.V. (valid until 23.07.2012). The registration number is TIC 15 100 96386. This certification provides for regular supervisory audits. Last supervisory audit was conducted 11-14 of May, 2010, and the validity of the certificate was confirmed. Procedures for dealing with data gaps and uncertainty conducts with accordance to this standard. E.Sova, *the chairman of the quality*, was responsible for the quality audit conducting.

C.4. Troubleshooting procedures:

Every day persons responsible for "Instruction on monitoring of the project "Utilization of surplus coke oven gas with the electricity generation at JSC "Yasynivskyi Coke Plant" (dated 6.05.2006) fulfillment reports to the Vice-chief of heat and power sector of the plant about any malfunctioning. So, in case of any meter failure, data discrepancy will be found within one day. The meter will be substituted by working one. CO2 emissions reduction will be calculated by cross-checking method for this period. If any inappropriateness of monitored data is revealed, corrective measures will be conducted either on the monitoring system for the item specified above. In such case, monitored data will be corrected in a conservative manner. All the information of corrective measures taken on the monitoring system and monitored data itself will be archived along with original monitored data for future verification of emission reductions.

SECTION D. Calculation of GHG emission reductions

D.1. Tables providing the formulas used:

Formulas used were taken from the PDD.

Table 12. Project emissions estimation

	Data variable	Method of calculation
PE_y	Project emissions in year y	$PE_y = PE_{AF,y} + PE_{EL,y} + PE_{EL,\mathrm{Im}\,port,y}$
$PE_{EL,y}$	Project emissions from usage of electrical energy on gas cleaning equipment which is used for additional cleaning of coke gas before using it in boilers in comparison to alternative flaring on open flare	It is not used in this project, therefore emissions equal to zero (see PDD section D.1.1.2)
$PE_{EL,\mathrm{Im}\,port,y}$	Project activity emissions from import of electricity replacing captive electricity generated in the absence of the project activity	It is not used in this project because possible substitution will be carried out by electrical energy produced by project turbo-units and is considered when calculating base line (see PDD section D.1.1.2)
$PE_{AF,y}$	Project emissions due to auxiliary fossil fuel consumption by the CHP plant	$PE_{AF,y} = \sum FF_{i,y} \cdot NCV_i \cdot EF_{CO2_i}$
$FF_{i,y}$	Amount of coal combusted supplementary with coke gas in CHP plant boilers as a result of project activities, in the year *y*	$\sum FF_{i,y} = \sum FF_{A,i,y} - \sum FF_{A,i,BL}$
$FF_{A,i,y}$	Annual consumption of coal by CHP plant boilers after project implementation;	Monitoring data from weighting machine (see Table 8)
$FF_{A,i,BL}$	Average annual consumption of coal by heat generation plant boilers three years before project implementation	1,419 *ths.tons* (see Table 7)
NCV_i	Net calorific value of coal combusted as supplementary fuel during project activity	20,272 *TJ/ths.tons* (see Table 9)
EF_{CO2_i}	CO_2 emission factor for coal combusted as supplementary fuel during project activities.	98,27 t CO_2/TJ (see Table 6)

Table 13. Baseline emissions estimation

	Data variable	Method of calculation
BE_y	The total baseline emissions during the year *y* in tons of CO_2	$BE_y = BE_{En,y} + BE_{flst,y}$
$BE_{En,y}$	The baseline emissions from energy generated by project activity during the year *y* in tons of CO_2	$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y}$
$BE_{flst,y}$	Baseline emissions from steam generation if any, using fossil fuel that would have been used for flaring the coke oven gas in absence of the project activity (tons CO2 per year *y*)	$BE_{flst,y} = 0$ (see PDD section B.2)
$BE_{Elec,y}$	Baseline emissions for energy production during the year *y*, tons CO_2	$BE_{Elec,y} = f_{cap} \cdot f_{wcm} \cdot EG_y \cdot EF_{Elec,produc}$
$BE_{Ther,y}$	Baseline emissions for thermal energy generation for the year *y*, tons CO_2	$BE_{Ther,y} = 0$ (see PDD section B.2)
EG_y	Amount of energy, produced within the framework of the project for the year *y*, which would have been generated by Ukrainian United Energy System power stations, that use fossil fuels	$EG_y = \sum_{i=1}^{4} EG_{gen,i,y} - EC_{PJ,\mathrm{Im}\,port,y} - EG_{own,y}$
$\sum_{i=1}^{4} EG_{gen,i,y}$	General amount of electrical energy produced by the enterprise's generators after project activity implementing in the year *y*	Monitoring data from electricity meters (see Table 8)
$EC_{PJ,\mathrm{Im}\,port,y}$	Amounts of electricity generated by existing equipment in the absence of project activity	$EC_{PJ,\mathrm{Im}\,port,y} = \max\{EG_{captive,B}; EC_{PJ,\mathrm{Im}\,port,y}(calculated); EC_{PJ,\mathrm{Im}\,port,y}(measured)\}$
$EG_{own,y}$	Energy consumption for own needs by turbines that are installed according to project activity, in the year *y*	$EG_{own,y} = EG_{own,y,1} + EG_{own,y,2}$
$EG_{own1,y}$	Energy consumption for own needs of PT-12 generator 1 which is installed according to project activity, in the year *y*	(see Table 9).
$EG_{own2,y}$	Energy consumption for own needs of PT-12 generator 2 which is installed according to project activity, in the year *y*	Not applicable for this monitoring period. $EG_{own2,y} = 0$.
$EG_{captive,B}$	Maximum electricity production by AR-6 turbines during three years before the first PT-12 turbine was installed according to the project	36 985 *MWh* (see Table 7).

$EC_{PJ,\mathrm{Im}\,port,i,y}$ *(calculated)*	Amount of electricity generated by AR-6 turbine before project activity implementation, in the year *y,* calculated, if direct measuring is impossible	According to ACM0012 the amount of electricity should preferably be measured.
$EC_{PJ,\mathrm{Im}\,port,i,y}$ *(measured)*	Measured by meter value of electricity generated by AR-6 turbine after project activity implementation, in the year *y*	$EC_{PJ,\mathrm{Im}\,port,i,y}$ (*measured*) = $EG_{gen,1,y}$ + $EG_{gen,2,y}$ (see Table 8)
$EF_{Elec,produc}$	Emission factor, which is used in cases of electricity displacement in the National Energy System of Ukraine for the electricity, generated within the implementation of the project activity	1,067 tCO2/*MWh* (see Table 6)
f_{wcm}	Fraction of total electricity generated with the use of coke oven gas in the framework of the project from the general amount of electricity, generated during implementation of the project activity	$f_{WCM} = \frac{\sum_{h=1}^{8760} Q_{WCM,h} \cdot (Cp_{wcm} \cdot (t_{wcm,h} - t_{ref}) + NCV_{WCM,y})}{EG_{tot,y}}$
f_{cap}	Energy that would have been produced in project year y using waste energy generated in base year expressed as a fraction of total energy produced using waste source in year y	$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}}$ f_{cap} will become more than 1 and will be automatically set to 1 as per the definition of fcap in ACM0012 (the ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base year). (See PDD section B.2)
$Q_{WCM,h}$	Quantity of coke oven gas recovered in hour h, (m3/h)	Monitoring data from coke oven gas flow meter (see Table 8)
$NCV_{WCM,y}$	Net Calorific Value of coke oven gas in year y, (TJ/m3)	Determined by plant's laboratory calorimeter (See Table 9).
$EG_{tot,y}$	Total annual electric energy produced at the CHP, (TJ/year)	$EG_{tot,y} = \sum_{i=1}^{4} EG_{gen,i,y} \cdot 0{,}0036$; where 0,0036 – recalculation factor from *MWh* to *TJ*.
Cp_{wcm}	Specific Heat of coke oven gas, (TJ/ m3-deg C)	Coke oven gas is supplied to the CHP after its cooling. Thus was accepted that $t_{wcm,h} = t_{ref}$. Hence equation: $Cp_{wcm} \cdot (t_{wcm,h} - t_{ref}) = 0$
$t_{wcm,h}$	The temperature of coke oven gas in hour h (deg C)	Coke oven gas is supplied to the CHP after its cooling. Thus was accepted that $t_{wcm,h} = t_{ref}$. Hence equation: $Cp_{wcm} \cdot (t_{wcm,h} - t_{ref}) = 0$
t_{ref}	Reference temperature (0 deg C or any other suitable reference temperature with proper	Coke oven gas is supplied to the CHP after its cooling. Thus was accepted that $t_{wcm,h} = t_{ref}$. Hence equation:

	justification)	$Cp_{wcm} \cdot (t_{wcm,h} - t_{ref}) = 0$
H_r	Average heat rate of the power plant where electricity is produced	$H_r = \frac{\sum_{h=1}^{8760} \sum_{i=1}^{I} Q_{i,h} \cdot (Cp_i \cdot (t_{i,h} - t_{ref}) + NCV_i)}{EG_{tot,y}}$
$Q_{i,h}$	Amount of individual fuel (coke oven gas and coal) i consumed at the energy generation unit during hour h, (kg or m3)	Monitoring data from coke oven gas flow meter ($Q_{i,h} = Q_{WCM}$) and weighting machine ($Q_{i,h} = FF_{A,i,y}$), (see Table 8)
C_{pi}	Specific Heat of individual fuel i (TJ/kg -deg C or TJ/ m3-deg C);	Coke oven gas is supplied to the CHP after its cooling. Thus was accepted that $t_{wcm,h} = t_{ref}$. Hence equation: $(Cp_i \cdot (t_{i,h} - t_{ref}) = 0$
NCV_i	Net Calorific Value annual average for coke oven gas and coal consumed (TJ/kg or TJ/m3)	See Table 9.
$t_{i,h}$	The temperature of individual fuel (coke oven gas and coal) i consumed at the CHP boilers during hour h (deg C).	Coke oven gas is supplied to the CHP after its cooling. Thus was accepted that $t_{wcm,h} = t_{ref}$. Hence equation: $(Cp_i \cdot (t_{i,h} - t_{ref}) = 0$
$Q_{OE,BL}$ -	Output/intermediate energy that can be theoretically produced (in appropriate unit).	$Q_{OE,BL} > Q_{OE,y}$, thus f_{cap} will become more than 1 and will be automatically set to 1 as per the definition of fcap in ACM0012
$Q_{OE,y}$	Quantity of actual output/intermediate energy during year y (in appropriate unit).	$Q_{OE,BL} > Q_{OE,y}$, thus f_{cap} will become more than 1 and will be automatically set to 1 as per the definition of *fcap* in ACM0012

D.2. Description and consideration of measurement uncertainties and error propagation:

The hand readings of the meters cause additional uncertainties. In case of obvious errors occurred, monitored data will be corrected in a conservative manner. All the information of corrective measures taken on the monitoring system and monitored data itself will be archived along with original monitored data for future verification of emission reductions. The data received directly from meters is taken with the level of uncertainty taking into account. During calculation of the GHG emissions the level of uncertainty is taken into account according to the Article 10 of "Law of Ukraine on Metrology and Metrological Activity", which states about the results of measurements usage.

D.3. GHG emission reductions (referring to B.2. of this document):

D.3.1. Project emissions:

Period	**Project emissions, $tCO_{2eq.}$**
1.01.2010-31.12.2010	177
Total 2010	**177**

D.3.2. Baseline emissions:

Period	**Baseline emissions, $tCO_{2eq.}$**
1.01.2010-31.12.2010	69399
Total 2010	**69399**

D.3.3. Leakage:

Not Applicable.

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

Period	Emissions reductions, $tCO_{2eq.}$
1.01.2009-31.12.2009	69222
Total 2010	**69222**

The main reasons for the difference in the amount of ERUs in PDD and in Monitoring report are the following:

- Emission factor for electricity grid, that was applied in monitoring report, is higher than emission factor that was applied during PDD preparation;
- Difference between the amount of electric energy generated actually and the amount that was planned to generate in PDD;
- Difference between the amount of coal consumed by CHP boilers actually and the amount that was planned to consume in PDD.

Annex1

Monitoring scheme for electrical power generation at PJSC «YCP» project