SECOND PERIODIC MONITORING REPORT

Version 2.0
26 May 2011

CONTENTS

ANNEXES

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SECTION A. General project activity and monitoring information

A.1 Title of the project activity:

"Energy efficiency investment program at OJSC ArcelorMittal Steel Kryviy Rih".
Sectoral scope 09: Metal Production

A.2. JI registration number:

0075
ITL Project ID: UA1000258

A.3. Short description of the project activity:

The project is aimed at increase of energy efficiency in production process and energy infrastructure at the biggest Ukrainian full cycle metallurgical plant OJSC ArcelorMittal Kryviy Rih (AMKR). The plant being one of the most up-to-date in the country metallurgy sector, however has a potential for reduction of specific energy consumption.

The energy efficiency assessment conducted at AMKR had identified eight key measures which are being implemented. These measures will contribute in reduction of specific energy consumption and importantly will lead to reduction of CO2 emissions.

Expected results

The proposed JI project envisages the implementation of eight sub-projects to increase the energy effectiveness of complex's operations. The estimated total investment is over 100 million USD.

Sub project	UAH	USD(*)
1. Modernization of Air Separating Unit:	142,000,000	27,949,206
2. Modernization of Compressors Station	28,000,000	5,511,111
3. Switch fuel from NG to COG+BFG+NG mixtures[1]	47,000,000	9,250,794
4. Refurbishment of Energy Distribution System	48,000,000	9,447,619

[1] NG is natural gas, COG is coke oven gas, and BFG is blast furnace gas.

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Sub project	UAH	USD(*)
5. New Gas Burner Installation	17,500,000	3,444,444
6. Turbo Generators Installation	157,000,000	30,901,587
7. BF top Recovery Turbine Installation	60,000,000	11,809,524
8. Heat recovery in Refractory and Lime Rotary Kilns	18,900,000	3,720,000
TOTAL	**518,400,000**	**102,034,286**

(*) based on exchange ratio of 0.1968 USD/UAH

Table 1: Energy Efficiency Investment Programme

The overall objective of the JI Project is to generate Emission Reduction Units (ERUs) by reducing about 1.6 million tons of CO_2 emissions before the end of 2012 by saving around 580 GWh of electricity and 35 Mln m^3 of NG per year.
The investment program is largely environmentally oriented; it will improve the efficiency in the use of resources and it will apply modern technologies.
Moreover, the implementation of this Project will offer a number of socio-economic impacts to the region as shortly described here below:

- Implementation of the project will lead to improvement of environmental climate in the region, prevent reduction of working places and improve working conditions;
- The investment will increase economic activity by use of local civil engineering and related contractors for the implementation of the project;
- The project will increase the overall resource efficiency and therefore will strengthen the market position of the company. This will increase the job security of the people directly or indirectly dependent on the plant.

ArcelorMittal investment in the Company is a landmark transaction for Ukraine and its transition to a market economy. It has the potential to demonstrate to other foreign investors the benefits arising from a transparent privatization, successful restructuring and introduction of international business management practices. ERUs generation can stimulate improvements in reducing energy consumptions and improving environmental performance.

Brief information on subproject activities:
The subproject 1 ”Modernization of Air Separating Unit” is partially implemented and operates in a commissioning mode. The performance of the unit is monitored separately.
In the subproject 2 “Modernization of Compressors Station“1 compressor out of 8 intended was implemented, but due to unbalanced load no emission reduction units were generated. By the end of this year second compressor is due to be commissioned. .

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The subproject 4 “Refurbishment of Energy Distribution System” is still in the implementation stage. First stage installation is scheduled to be completed by the end of the year.
The subproject 5 “New Gas Burner Installation” was implemented in 2008 but due to the lack of coke gas and lower production level than anticipated in the project planning it didn’t reach designed capacity.
The subproject 6 “Turbo Generators Installation” is at the stage of equipment supplier selection.
Subprojects 7 and 8 are still at the consideration stage.

Thus only subproject 3 has been included in the monitoring report for the period indicated in section A4 and has been generating emission reductions.
Inclusion of only subproject 3 does not lead to changes in monitoring plan.

Subproject #	SP name	Starting date	Comments
3	Fuel switch from NG to NG+COG+BFG mixture at rolling mill #3 (RM#3)	21.05.2008	
3	Fuel switch from NG to NG+COG+BFG mixture at wire rod rolling mill #3 (WRRM#3)	27.05.2008	
3	Fuel switch from NG to NG+COG+BFG mixture at light-section rolling mill #5 (LSRM#5)	16.11.2009	

Table 2: Subprojects generating emission reduction within the monitoring period stated in A.4 (2010).

Subproject 3 description

The sub-project #3 consists of the partial replacement of natural gas used in rolling shops of the plant with gas mixture of blast furnace gas/coke oven gas/natural gas (BFG+COG+NG) by replacing burners, installing and connecting system of gas mixing and installing boosting stations.

The heat content associated with the use of waste gases that otherwise would be lost through combustion in a flare is equal to the heat content of the equivalent amount of natural gas that would be used in the baseline. Replacement of NG by COG+BFG+NG mixture for the heating of reheating furnaces of rolling mill#3 (RM#3), wire rod rolling mill #3 (WRRM#3) and light-section rolling mill #5 (LSRM#5) has been implemented during 2008-2009. Currently gas mixture of COG, BFG and NG is being used instead of NG only. The flow diagrams shown in Fig. 1, 2, 3, 4, 5 describe individual gas and mixture flows as well as gas metering points before and after project implementation.

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As a result of SP3 implementation, RM#3, wire rod rolling mill #3 (WRRM#3) and light-section rolling mill #5 (LSRM#5) have significantly (approximately two times) reduced consumption of NG. This amount of NG has been replaced by a large amount of COG and BFG that are utilized instead of being flared.

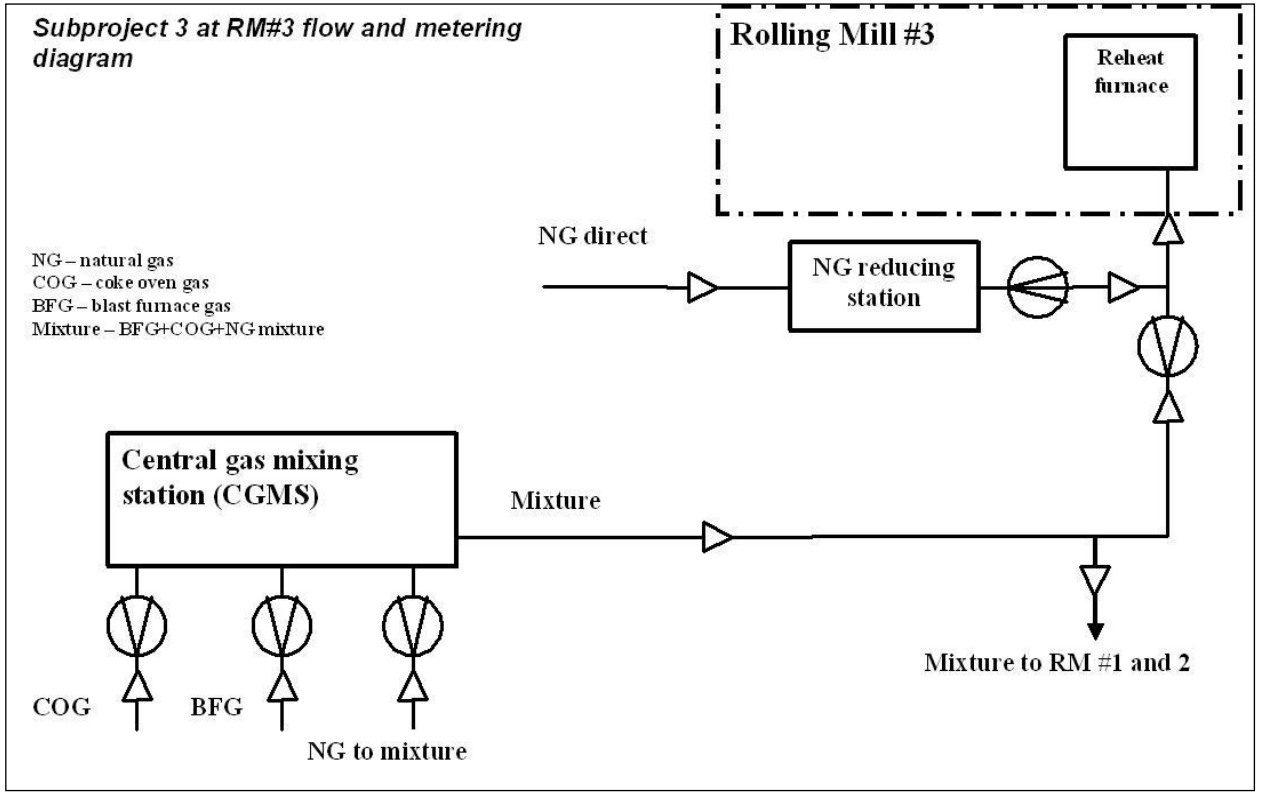

Figure 1: Flow and metering diagram of SP3 at rolling mill #3

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Fuel supply diagram for Light-section rolling mill #5 before the fuel switch from NG to COG+BFG+NG project implementation

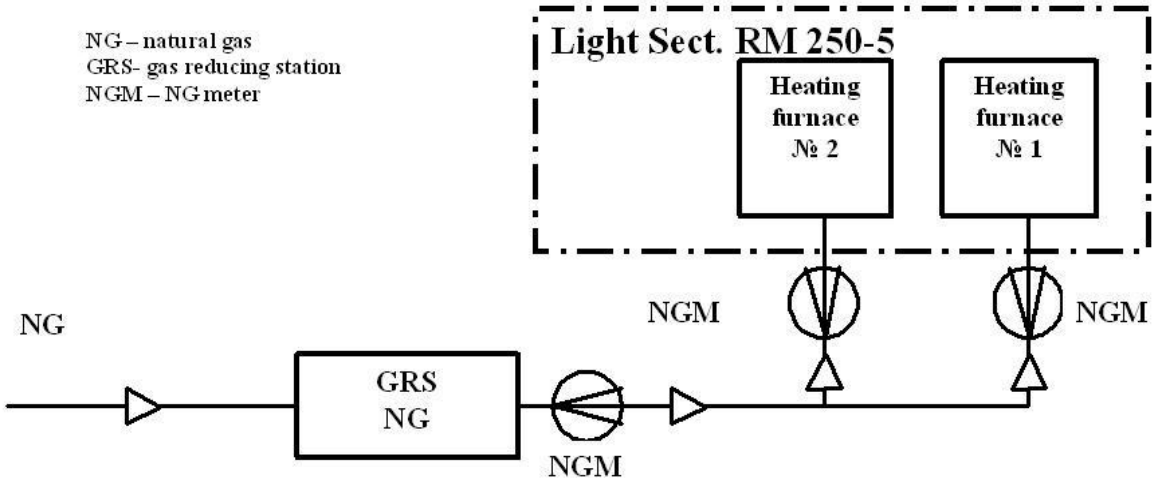

Figure 2: Flow and metering diagram of SP3 at light-section rolling mill #5, situation before project implementation

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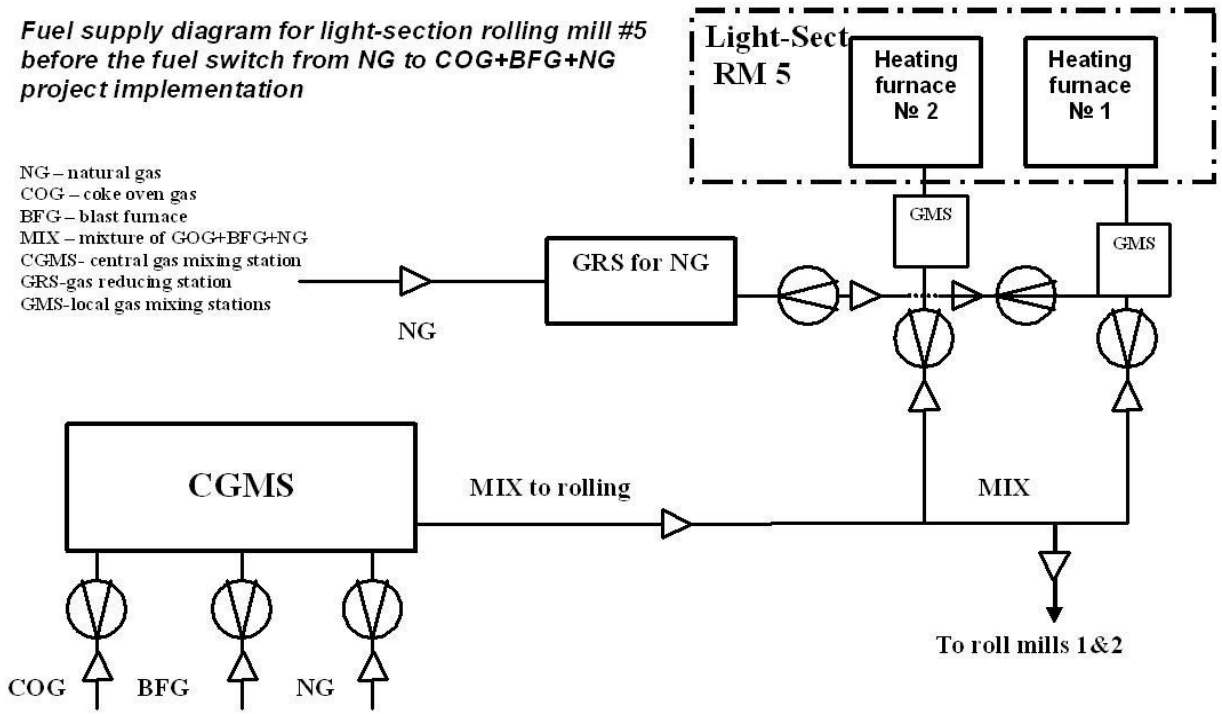

Figure 3: Flow and metering diagram of SP3 at light-section rolling mill #5, situation after project implementation

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Flow and metering diagram before implementation of project fuel switch from NG to COG+BFG+NG at wire rolling mill #3 250-3

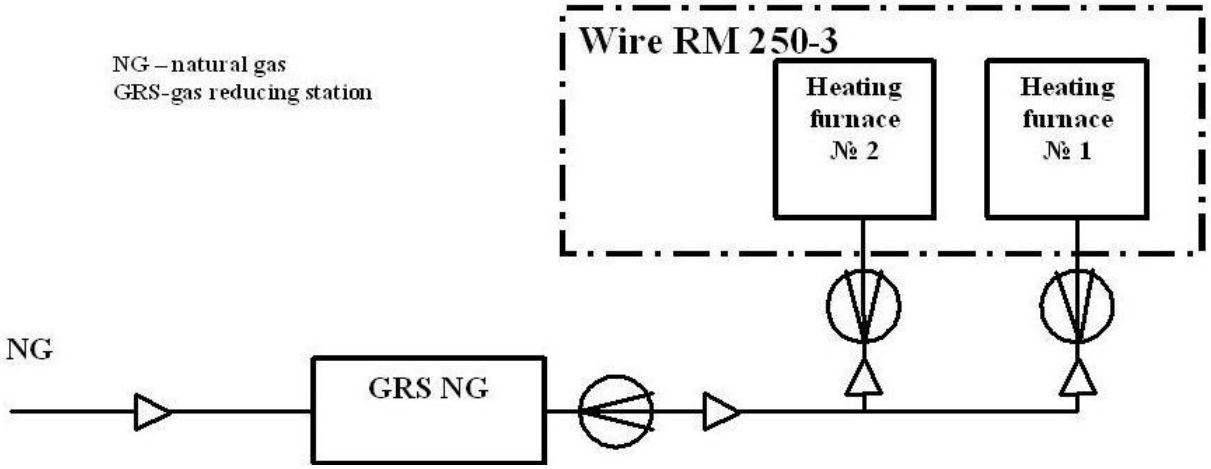

Figure 4: Flow and metering diagram of SP3 at wire roll mill #3, situation before project implementation

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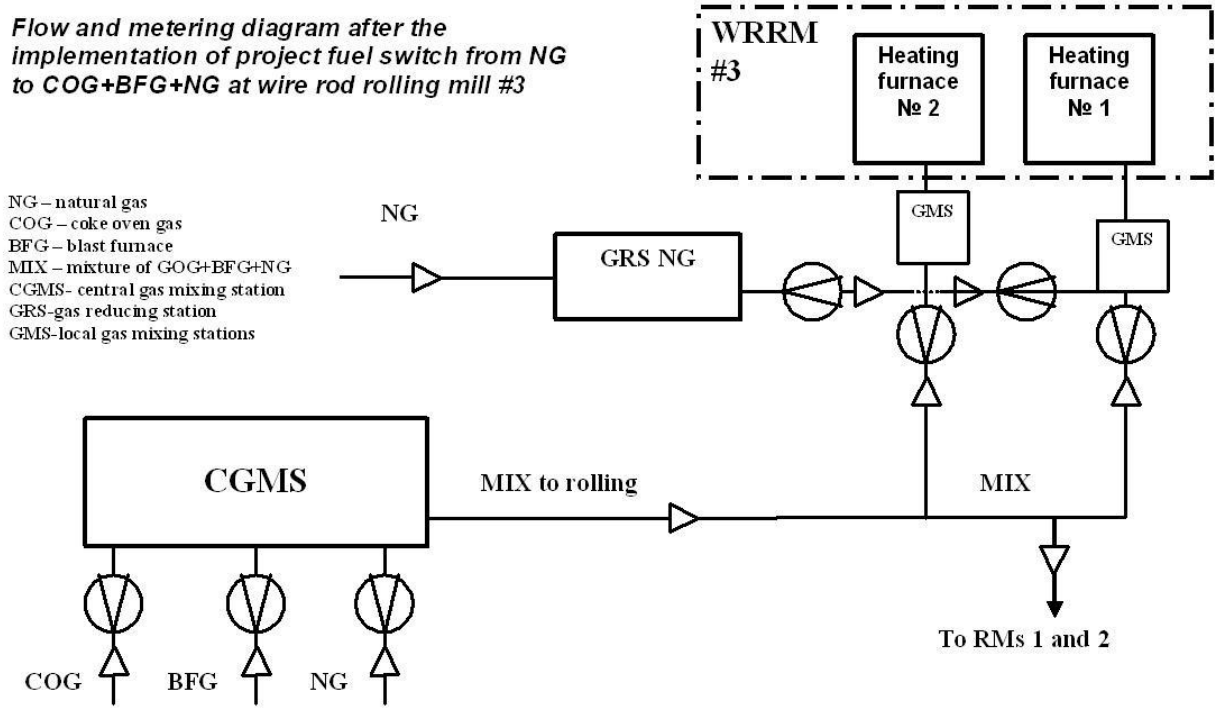

Figure 5: Flow and metering diagram of SP3 at wire rod rolling mill #3; situation after project implementation

A.4. Monitoring period:

- Monitoring period starting date: 01.01.2010 at 00:00;
- Monitoring period closing date: 31.12.2010 at 24:00

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

A.5.1. Baseline methodology:

The JI specific approach regarding baseline setting and monitoring has been developed for the subprojects in accordance with Appendix B of the JI Guidelines[2] and with the JISC Guidance on Criteria for Baseline Setting and Monitoring[3].

Subproject 3: Switch from NG to BFG+COG+NG mixture

According to the approach selected, the actual fuel demand of RM#3, WRRM#3 and LSRM#5 in the baseline scenario is covered by natural gas only. Fuel demand in the baseline is taken equal to the actual demand in project scenario, in which it is being covered by BFG+COG+NG mixture. Monitoring of actual consumption of gas mixture, shares of individual gases in the mixture and their actual NCVs allows for accurate and transparent calculation of the baseline emissions.

A.5.2. Monitoring methodology:

Subproject 3: Switch from NG to BFG+COG+NG mixture

Usage of COG and BFG in project scenario does not generate emissions as these gases otherwise are flared. Their usage substitutes the respective amount of NG. In the baseline all demand is covered by NG only.

Therefore, the following parameters are to be monitored:

- the full NG consumptions of RM#3, WRRM#3 and LSRM#5 which includes direct NG consumption (metered at gas reducing station and NG consumed as a part of BFG+COG+NG mixture (calculated based on metered data);
- Gas mix consumptions (metered at the entrances of RM#3, WRRM#3 and LSRM#5);
- NCV of NG (monitored based on NG certificates regularly provided by NG supplier);
- NCV of COG and BFG;
  The NCV of gas mix and the share of NG in the gas mix are calculated based on NCVs of NG, CG and BFG and next metered data at the central gas mixing station (CGMS):

[2] http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2

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

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- Amount of BFG entering the CGMS;
- Amount of COG entering the CGMS;
- Amount of NG entering the CGMS.

Assumptions:

- The technical lifetime of the existing and installed equipment can last to at least the end of the crediting period;
- Heat demands of RM#3, WRRM#3 and LSRM#5 in the baseline are equal to those of the project scenario;
- Without the proposed project the heat demands of RM#3, WRRM#3 and LSRM#5 would be covered by combustion of NG only;
- The IPCC default CEF of NG combustion is used.

The resulting emissions in the baseline and project scenarios will then be calculated using the IPCC default emission factor for NG combustion.

Gases entering central gas mixing station (CGMS), SP3

ID	Data type	Data variable	Data unit	Measured M Calculated C Estimated E	Proportion of data to be monitored	Data recording	Archived data	Comment
1.	BFG consumption at CGMS in year y	**$BFG_{CGMS, y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
2.	COG consumption at CGMS in year y	**$COG_{CGMS, y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
3.	NG consumption at CGMS in year y	**$NG_{CGMS, y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

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4.	NCV of BFG in year y	$\mathbf{NCV_{BFG, y}}$	kcal/ Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
5.	NCV of COG in year y	$\mathbf{NCV_{COG, y}}$	kcal/ Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
6.	NCV of NG in year y	$\mathbf{NCV_{NG, y}}$	kcal/ Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
7.	NCV of gas mix in year y	$\mathbf{NCV_{MIX, SP3, PS,y}}$	kcal/ Normalized m^3	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

Table 3: Gases entering central gas mixing station (CGMS), SP3

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Baseline emissions calculation of RM#3, SP3

ID	Data type	Data variable	Data unit	Measured M Calculated C Estimated E	Proportion of data to be monitored	Data recording	Archived data	Comment
8.	Baseline GHG emissions of RM#3 in the year y.	**$BE_{SP3, RM3, y}$**	tCO_2	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
9.	Baseline NG consumption by RM3	**$NG_{SP3,BS,RM3, y}$**	Normalized m^3	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
10.	Direct NG consumption by RM3 in year y	**$NG_{Direct, SP3, PS, RM3, y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
11.	Mixture of BFG, COG and NG consumption by RM3 in year y	**$MIX_{SP3, PS, RM3, y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

Table 4: Baseline emissions of RM#3, SP3

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Baseline emissions calculation of WRRM#3, SP3

ID	Data type	Data variable	Data unit	Measured M Calculated C Estimated E	Proportion of data to be monitored	Data recording	Archived data	Comment
12.	Baseline GHG emissions of WRRM#3 in the year y.	**$BE_{SP3, WRRM3,y}$**	tCO_2	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
13	Baseline NG consumption by WRRM3	**$NG_{SP3,BS,WRRM3, y}$**	Normalized m^3	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
14.	Direct NG consumption by WRRM3 in year y	**$NG_{Direct,SP3,PS,WRRM3,y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
15.	Mixture of BFG, COG and NG consumption by WRRM3 in year y	**$MIX_{SP3, PS, WRRM3 y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

Table 5: Baseline emissions of WRRM#3, SP3

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Baseline emissions calculation of LSRM#5, SP3

ID	Data type	Data variable	Data unit	Measured M Calculated C Estimated E	Proportion of data to be monitored	Data recording	Archived data	Comment
16.	Baseline GHG emissions of LSRM#5 in the year y.	**$BE_{SP3, LSRM5,y}$**	tCO_2	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
17.	Baseline NG consumption by LSRM5	**$NG_{SP3,BS,LSRM5, y}$**	Normalized m^3	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
18.	Direct NG consumption by LSRM5 in year y	**$NG_{Direct,SP3,PS,LSRM5,y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
19.	Mixture of BFG, COG and NG consumption by LSRM5 in year y	**$MIX_{SP3, PS, LSRM5 y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

Table 6: Baseline emissions of LSRM#5, SP3

The project emissions of SP3 will be calculated by monitoring of direct and indirect NG consumption and amount of NG+CG+BFG mix consumed.

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Project emissions calculation of RM#3, SP3

ID	Data type	Data variable	Data unit	Measured M Calculated C Estimated E	Proportion of data to be monitored	Data recording	Archived data	Comment
20.	Project GHG emissions of RM#3 in year y	$\mathbf{PE_{SP3, RM3,y}}$,	tCO_2	c	100%	Electronic and paper	Two years after last Carbon Credit delivery (April 2013)	
21.	Total NG consumption by RM3 in year y	$\mathbf{NG_{SP3,PS\ RM3,y}}$	Normalized m^3	c	100%	Electronic and paper	Two years after last Carbon Credit delivery (April 2013)	
22.	RM3 NG consumption from gas mix in year y	$\mathbf{NG_{MIX, SP3, PS, y}}$	Normalized m^3	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
23.	RM3 mix of gases consumption in year y	$\mathbf{MIX_{SP3, PS,RM3, y}}$	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
24.	Direct NG consumption by RM3 in year y	$\mathbf{NG_{Direct, SP3, PS, RM3, y}}$	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

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25.	Volumetric share of NG in gas mix in year y	**$\%NG_{MIX,SP3,PS,RM3,y}$**	*dimensionless*	*c*	*100%*	Electronic and paper	Two years after last Carbon Credit delivery (April 2013)	

Table 7: Project emissions of RM#3, SP3

Project emissions calculation of WRRM#3, SP3

ID	Data type	Data variable	Data unit	Measured M Calculated C Estimated E	Proportion of data to be monitored	Data recording	Archived data	Comment
26.	Project emissions of WRRM#3 in year y	**$PE_{SP3, WRRM3,y}$,**	tCO_2	c	100%	Electronic and paper	Two years after last Carbon Credit delivery (April 2013)	
27.	Total NG consumption by WRRM3 in year y	**$NG_{SP3,PS\ WRRM3,y}$**	Normalized m^3	c	100%	Electronic and paper	Two years after last Carbon Credit delivery (April 2013)	
28.	WRRM3 NG consumption from gas mix in year y	**$NG_{MIX, SP3, WRRM3, PS,y}$**	Normalized m^3	c	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
29.	WRRM3 mix of gases consumption in year y	**$MIX_{SP3,WRRM3,PS,RM3,y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

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30.	Direct NG consumption by WRRM3 in year y	**$NG_{Direct,SP3,WRRM3,PS,y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

Table 8: Project emissions of SP3/WRRM#3

Project emissions calculation of LSRM#5, SP3

ID	Data type	Data variable	Data unit	Measured M Calculated C Estimated E	Proportion of data to be monitored	Data recording	Archived data	Comment
31.	Project emissions of LSRM5 in year y	**$PE_{SP3, LSRM5,y}$,**	tCO_2	c	100%	Electronic and paper	Two years after last Carbon Credit delivery (April 2013)	
32.	Total NG consumption by LSRM5 in year y	**$NG_{SP3, LSRM5,PS,y}$**	Normalized m^3	c	100%	Electronic and paper	Two years after last Carbon Credit delivery (April 2013)	
33.	LSRM5 NG consumption from gas mix in year y	**$NG_{MIX, SP3, LSRM5, PS, y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	
34.	LSRM5 mix of gases consumption in year y	**$MIX_{SP3, LSRM5, PS,, y}$**	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

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35.	Direct NG consumption by LSRM5 in year y	$NG_{Direct,SP3,LSRM5,PS,y}$	Normalized m^3	m	100%	Electronic and paper	At least two years after last Carbon Credit delivery (April 2013)	

Table 9: Project emissions of SP3/LSRM#5

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

Letters of Approval were issued by both parties:
Letter of Approval from NEIA of Ukraine #1522/23/7 from 05.10.2010
Letter of Approval from Luxembourg Departement de l'environnement #1 from 28.05.2010
Letters of Approval are available at:
http://ji.unfccc.int/JIITLProject/DB/JQ756K3VCDKV3E8T8G4GGFNP4C4IDC/details

Only subproject 3 has been implemented for the current monitoring period. (See section A.2. for clarification). Stages of its introduction are given below:
RM#3 has been connected to gas mixture supply and started using it 21/05/2008;
WRRM#3 has been connected to gas mixture supply and started using it 27/05/2008;
LSRM#5 has been connected to gas mixture supply and started using it 16/11/2009;

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

Changes during project implementation that have taken place at AMKR during last monitoring period were stated in the initial and first monitoring report ver2.0 and have been verified by AIE according to the procedures regarding changes during project implementation[4].
There were no deviations or revisions to the registered PDD and previous monitoring report during current monitoring period stated in the Section A.4.

[4] http://ji.unfccc.int/Sup_Committee/Meetings/022/Reports/Annex2.pdf

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Monitored amount of emissions reduction differs from the one expected in PDD for the respective period stated in A.4. as shown in the table below:

Year	2010
Subproject 3. ER in MR002 in tons of CO_2 equiv.	120 247
Subproject 3. ER in determined PDD in tons of CO_2 equiv.	47 841

Table 10: Monitored amount of ER and expected in PDD for 2010

ERU amount calculated in PDD version 04 from 4.08.2009 was an estimated value. Since then next changes during project implementation have taken place:

- Two shops (WRRM#3 and LSRM#5) were switched on mix of natural, blast furnace and coke gas consumption.
- Activities on switch from NG to NG+BFG mixture in refractory and lime rotary kilns were suspended.

Thus more emission reduction units than was planned in PDD were achieved due to expansion of Subproject 3.

A.8. Intended deviations or revisions to the registered monitoring plan

Deviations to the registered monitoring plan have been reflected in an updated monitoring plan (MP) used for previous monitoring period (01.01.2008 – 21.12.2009). The monitoring report for this period (stated in Section A.4.) has been prepared in accordance with that updated monitoring plan. There were no deviations to this monitoring plan.

A.9. Changes since the last verification:

Subproject #2 Modernization of Compressor Station did not reach intended capacity and was not considered in the current monitoring report. No other changes took place since the last verification.

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

ArcelorMittal Kryviy Rih

- Mrs. Liana Maksimenko, Director for Environment
- Mr. Vadim Yova head of energy management bureau

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ArcelorMittal Flat Carbon Europe S.A.

- Alex Churilov

Global Carbon B.V.

- Denis Prusakov, Senior Consultant
- Petruk Iurii, Junior Consultant

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

ArcelorMittal Kryviy Rih

- Mrs. Liana Maksimenko, Director for Environment

Global Carbon B.V.

- Denis Rzhanov, JI team leader

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SECTION B. Key monitoring activities

Subproject 3: Switch from NG to BFG+COG+NG mixture

Key monitoring activities for SP3 include:

- monitoring of actual composition of BFG+COG+NG gas mixture in order to calculate NCV of mixture and share of NG in it;
- monitoring of gas mixture consumption RM#3 , WRRM#3 and LSRM#5;
- monitoring of direct NG consumption of RM#3, WRRM#3 and LSRM#5

The monitored data are stored as well as the calculated variables.

B.1. Monitoring equipment:

Subproject 3: Switch from NG to BFG+COG+NG mixture

Consumption of gases at rolling mills as well as volume of gases entering the CGMS is metered the following way: every metering point is equipped with flow sensor with recorder, logging the daily consumption in form of a circular diagram, linear diagram or electronic memory. Similar to the flow metering, the pressure and temperature of gases are metered and recorded. The diagrams and electronic records are processed on a daily basis in the planimetric group belonging to the service for control and operation of control and instrumentation devices of AMKR. The obtained normalized daily consumptions are logged and reported to the energy department. This allows continuous monitoring and logging of 100% data of consumption of NG, COG, BFG and gas mix at CGMS and the rolling mills.

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B.1.2. Tables providing information on the equipment used (incl. manufacturer, type, serial number, date of installation, date of last calibration, accuracy):

Equipment, location	Measurement abbreviation	Manufacturer/ type	Serial number	Unit	Installation date	Accuracy	Last calibration	Next calibration	Comments
Individual gases entering the CGMS[5]									
NG consumption. CGMS #2 control room	**MNG_{CGMS}**	Flow recorder: DR4311	2038900017	Normalized m^3	2008	±0,25 %	06/2010	06/2011	
		Flow sensor: STD3000	4396001002	Normalized m^3	2008	±0,025 %	06/2010	06/2011	
		Pressure recorder: DR4311	2038900023	kg/cm^2	2008	±0,25 %	06/2010	06/2011	
		Pressure sensor: Sapfir22	209408	kg/cm^2	2008	±0,25 %	06/2010	06/2011	
		Temperature recorder: Technograph	93584	°C	2008	±0,25 %	06/2010	06/2011	Complex temperature measureme

[5] RM#3, LSRM#5 and WRRM#3 consume COG/BFG/NG mix prepared at CGMS. To obtain the NCV of mix and share of NG in it meter the data of CGMS are included in MR

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		Temperature sensor: TSM 50M	n/a	°C	2008	± 1.5 %	06/2010	06/2011	nt for all gases entering CGMS
COG consumption. CGMS#2 control room	**$MCOG_{CGMS}$**	Flow recorder: KSD3	357774	Normalized m^3	2000	± 1.5 %	06/2010	06/2011	
		Flow sensor: DM3583	799	Normalized m^3	2000	± 1.5 %	06/2010	06/2011	
		Pressure recorder: Disc-250	31613	kg/cm^2	1998	±0,5 %	06/2010	06/2011	
		Pressure sensor: Sapfir	904023	kg/cm^2	1998	±0,25 %	06/2010	06/2011	
		Flow recorder: Disc-250 BIK-1	31614 3292	Normalized m^3	1998	± 1 %	06/2010	06/2011	
		Flow sensor: Sapfir	904104	Normalized m^3	1998	±0,25 %	06/2010	06/2011	
		Pressure recorder: KSD3	309536	kg/cm^2	2000	± 1.5 %	06/2010	06/2011	
		Pressure sensor: DM3583	2888	kg/cm^2	2000	± 1.5 %	06/2010	06/2011	

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BFG consumption. CGMS#2 control room	**$MBFG_{CGMS}$**	Flow recorder: Disc-250 BIK-1	31605 3292	Normalized m^3	1998	± 1 %	06/2010	06/2011	
		Flow sensor: Sapfir	904104	Normalized m^3	1998	±0,25 %	06/2010	06/2011	
		Pressure recorder: Disc-250	31557	kg/cm^2	1998	±0,5 %	06/2010	06/2011	
		Pressure sensor: Sapfir	708273	kg/cm^2	1998	±0,25 %	06/2010	06/2011	
		Flow recorder: VFS	10558	Normalized m^3	1972	± 2 %	06/2010	06/2011	
		Flow sensor: DMIR	6247	Normalized m^3	1972	±0,25 %	06/2010	06/2011	
		Pressure recorder: VFS	14411	kg/cm^2	1972	± 2 %	06/2010	06/2011	
		Pressure sensor: DM3583	68719	kg/cm^2	1972	± 1.5 %	06/2010	06/2011	

Table 11: Devices used for measurement at CGMS

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Equipment, location	Measurement abbreviation	Manufacturer/ type	Serial number	Unit	Installation date	Accuracy	Last calibration	Next calibration	Comments
Consumption of gases by RM#3									
Direct NG consumption by RM#3. Gas reducing station of RM#3	**$MNG_{Dir, RM3}$**	Flow recorder: DR4311	1741000029	Normalized m^3	05/2008	± 1 %	12/2010	12/2011	
		Flow sensor: Rosemaun	7962954	Normalized m^3	08/2010	± 0,015 %	12/2010	12/2011	
		Pressure recorder: DR4311	1741000043	Kg/cm^2	05/2008	± 1 %	12/2010	12/2011	
		Pressure sensor: STD924	1499001024	Kg/cm^2	05/2008	± 1 %	12/2010	12/2011	
		Temperature recorder: DR4311	3253000003	ºC	05/2008	± 1 %	12/2010	12/2011	
		Temperature sensor: TSM 1088	n/a	ºC	05/2008	± 1 %	n/a	n/a	
COG+BFG+NG mix consumption by RM#3. Gas reducing station of RM#3	**$MMIX_{RM3}$**	Flow recorder: DR4311	1741000027	Normalized m^3	05/2008	± 1 %	12/2010	12/2011	
		Flow sensor: Metran	326612	Normalized m^3	05/2008	± 1 %	12/2010	12/2011	

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		Pressure recorder: DR4311	1741000051	Kg/cm^2	05/2008	± 1 %	12/2010	12/2011	
		Pressure sensor: STD924	1499001026	Kg/cm^2	05/2008	± 1 %	12/2010	12/2011	
		Temperature recorder: DR4311	1741000048	ºC	05/2008	± 1 %	12/2010	12/2011	
		Temperature sensor: TSM 1088	n/a	ºC	05/2008	± 1 %	n/a	n/a	

Table 12: Devices used for measurement at RM#3

Equipment, location	Measurement abbreviation	Manufacturer/ type	Serial number	Unit	Installation date	Accuracy	Last calibration	Next calibration	Comments
Consumption of gases by LSRM#5									
Direct NG consumption by LSRM#5. Gas reducing station of LSRM#5	**$MNG_{Dir,LSRM5}$**	Furnace 1. Flow recorder: BRU-10	1382	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	
		Furnace 1. Flow sensor: ARG-31.2	253	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	
		Furnace 1. Pressure recorder: BRU-10	1384	Kg /cm^2	11/2009	± 0,2 %	09/2009	08/2011	

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		Furnace 1. Pressure sensor: AIR-20/m2	20-23851	Kg /cm^2	11/2009	± 0,5 %	08/2010	05/2011	
		Temperature recorder: TPEI Controller	n/a	ºC	11/2009	± 0,5 %	05/2010	05/2011	Complex temperature measurement for both furnaces
		Temperature sensor: TSM 1088	n/a	ºC	11/2009	± 1 %	n/a	n/a	
		Furnace 2. Flow recorder: BRU-10	1394	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	
		Furnace 2. Flow sensor: ARG-31.2	254	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	
		Furnace 2. Pressure recorder: BRU-10	1395	Kg /cm^2	11/2009	± 0,2 %	09/2009	08/2011	
		Furnace 2. Pressure sensor: AIR-20/m2	20-36134	Kg /cm^2	11/2009	± 0,5 %	08/2010	05/2011	
COG+BFG+NG mix consumption by LSRM#5. Gas reducing station of LSRM#5	**MMIX $_{LSRM5}$**	Furnace 1. Flow recorder: BRU-10	851	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	
		Furnace 1. Flow sensor: ARG-31.2	249	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	

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		Furnace 1. Pressure recorder: BRU-10	1383	Kg /cm^2	11/2009	± 0,2 %	09/2009	08/2011	
		Furnace 1. Pressure sensor: AIR-20/m2	20-31195	Kg /cm^2	11/2009	± 0,5 %	08/2010	05/2011	
		Temperature recorder: TPEI Controller	n/a	ºC	11/2009	± 0,5 %	05/2010	05/2011	Complex temperature measurement for both furnaces
		Temperature sensor: TSM 1088	n/a	ºC	11/2009	± 1 %	n/a	n/a	
		Furnace 2. Flow recorder: BRU-10	852	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	
		Furnace 2. Flow sensor: ARG-31.2	250	Normalized m^3	11/2009	± 1 %	09/2009	08/2011	
		Furnace 2. Pressure recorder: BRU-10	1388	Kg /cm^2	11/2009	± 0,2 %	09/2009	08/2011	
		Furnace 2. Pressure sensor: AIR-20/m2	20-36135	Kg /cm^2	11/2009	± 0,5 %	08/2010	05/2011	

Table 13: Devices used for measurement at LSRM#5

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Equipment, location	Meter abbreviation	Manufacturer/ type	Serial number	Unit	Installation date	Accuracy	Last calibration	Next calibration	Comments
Consumption of gases by WRRM#3									
Direct NG consumption by WRRM#3 Gas reducing station of WRRM#3	**$MNG_{Dir,WRRM3}$**	Furnace 1. Flow recorder: Disc-250M	2305	Normalized m^3	07/2008	± 1 %	09/2010	09/2011	
		Furnace 1. Flow sensor: ARG-31.2	207	Normalized m^3	07/2008	± 1 %	09/2009	08/2011	
		Furnace 2. Flow recorder: BRU-10	2973	Normalized m^3	07/2008	± 1 %	09/2010	09/2011	
		Furnace 2. Flow sensor: ARG-31.2	208	Normalized m^3	07/2008	± 1 %	09/2009	08/2011	
		Furnace 1. Pressure recorder: Disc-250M	3017	Kg /cm^2	07/2008	± 1 %	09/2010	09/2011	
		Furnace 1. Pressure sensor: Metran-100	378762	Kg /cm^2	07/2008	± 0,5 %	09/2010	09/2011	
		Pressure recorder: Disc-250M	2308	Kg /cm^2	07/2008	± 1 %	09/2010	09/2011	

.

		Pressure sensor: Metran-100	376746	Kg /cm^2	07/2008	± 0,5 %	09/2010	09/2011	
		Temperature recorder: Disc-250M	2309	ºC	07/2008	± 1 %	03/2010	03/2011	Complex temperature measurement for both furnaces
		Temperature sensor: TSM 1088	n/a	ºC	07/2008	± 1 %	n/a	n/a	
COG+BFG+NG mix consumption by WRRM#3. Gas reducing station of WRRM#3	**MMIX $_{WRRM3}$**	Furnace 1. Flow recorder: DR4311	1741000028	Normalized m^3	07/2008	± 1 %	09/2010	09/2011	
		Furnace 1. Flow sensor: ARG-31.2	205	Normalized m^3	07/2008	± 1 %	08/2009	08/2011	
		Furnace 2. Flow recorder: DR4311	2038900020	Normalized m^3	07/2008	± 1 %	09/2010	09/2011	
		Furnace 2. Flow sensor: ARG-31.2	206	Normalized m^3	07/2008	± 1 %	08/2009	08/2011	
		Furnace 1. Pressure recorder: DR4311	3253000002	Kg /cm^2	07/2008	± 1 %	09/2010	09/2011	
		Furnace 1. Pressure sensor: STD924	1499005002	Kg /cm^2	07/2008	± 1 %	09/2010	09/2011	

.

		Furnace 2. Pressure recorder: DR4311	1741000047	Kg /cm^2	07/2008	± 1 %	09/2010	09/2011	
		Furnace 2. Pressure sensor: STD924	1499005014	Kg /cm^2	07/2008	± 1 %	09/2010	09/2011	
		Temperature recorder: Disc-250M	3139	ºC	07/2008	± 1 %	03/2010	03/2011	Complex temperature measurement for both furnaces
		Temperature sensor: TSM 1088	n/a	ºC	07/2008	± 1 %	n/a	n/a	

Table 14: Devices used for measurement at WRRM#3

B.1.3. Calibration procedures:

For sensors and recording devices:

QA/QC procedures	Bodies responsible for calibration and certification
Calibration interval of all recorders and sensors is 1 year. For flow sensors ARG-31.2 and flow recorders BRU-10 calibration period is 2 years	Internal plant service Ukrainian Centre for Standardization and Metrology

B.1.4. Involvement of Third Parties:

Ukrainian Centre for Standardization and Metrology, State Dnepropetrovsk regional center for standardization, metrology and certification (SE “Dneprstandartmetrology”)

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Kryviy Rih transmission department of Ukrtransgas (gas transmission company, a part of NAK Naftogas) is the natural gas supplier of AMKR. It regularly provides gas certificates containing data on NG NCV to AMKR.

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

Subproject 3: Switch from NG to BFG+COG+NG mixture

Data variable	Source of data	Data unit	Value
EF_{NG} carbon emission factor of natural gas	*Default factor, 2006 IPCC Guidelines , http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html, V.2-Energy, Table 1.4*	tCO_2/GJ	0.0561

Table 15: Fixed default values for SP3

B.2.2. List of variables:

Subproject 3: Switch from NG to BFG+COG+NG mixture

Data variable	Data unit	Method of calculation	Meters used
$BE_{SP3, y}$, Baseline emissions in the year y.	tCO_2	calculated	
$PE_{SP3, y}$, Project emissions in the year y.	tCO_2	calculated	
MIX $_{SP3, PS, RM3,y}$ RM3 consumption of GOG+BFG+NG mix in year y	1000 Normalized m^3	Measured	$MMIX_{RM3}$
MIX $_{SP3, PS, WRRM3,y}$ WRRM3 consumption of GOG+BFG+NG mix in year y	1000 Normalized m^3	Measured	$MMIX_{WRRM3}$
MIX $_{SP3, PS, LSRM5,y}$ LSRM5 consumption of GOG+BFG+NG mix in year y	1000 Normalized m^3	Measured	$MMIX_{LSRM5}$

.

NG $_{Dir, SP3, PS, RM3, y}$ Direct consumption of NG by RM3 in year y	1000 Normalized m^3	Measured	$MNG_{Dir\ RM3}$
NG $_{Dir, SP3, PS, WRRM3, y}$ Direct consumption of NG by WRRM3 in year y	1000 Normalized m^3	Measured	$MNG_{Dir\ WRRM3}$
NG $_{Dir, SP3, PS, LSRM5, y}$ Direct consumption of NG by LSRM5 in year y	1000 Normalized m^3	Measured	$MNG_{Dir\ LSRM5}$
NG $_{SP3, BS, RM3, y}$ Baseline NG consumption by RM3	1000 Normalized m^3	*calculated*	
NG $_{SP3, BS, WRRM3, y}$ Baseline NG consumption by WRRM3	1000 Normalized m^3	*calculated*	
NG $_{SP3, BS, LSRM5, y}$ Baseline NG consumption by LSRM5	1000 Normalized m^3	*calculated*	
NG$_{SP3, PS, RM3,y}$ Project NG total consumption of RM3	1000 Normalized m^3	*calculated*	
NG$_{SP3, PS, LSRM5,y}$ Project NG total consumption of LSRM5	1000 Normalized m^3	*calculated*	
NG$_{SP3, PS, WRRM3,y}$ Project NG total consumption of WRRM3	1000 Normalized m^3	*calculated*	
NG$_{MIX, P3, PS, RM3,y}$ Project NG consumption of RM3 from raw mix in year y	1000 Normalized m^3	*calculated*	
NG$_{MIX, P3, PS, WRRM3,y}$ Project NG consumption of WRRM3 from raw mix in year y	1000 Normalized m^3	*calculated*	

.

$NG_{MIX, P3, PS, LSRM5,y}$ Project NG consumption of LSRM5 from raw mix in year y	1000 Normalized m^3	*calculated*	
$\%NG_{MIX, P3, PS, y}$ share of NG in gas mix in year y	dimensionless	*calculated*	
$BFG_{CGMS,y}$ Amount of BFG used at CGMS in year y	1000 Normalized m^3	*Measured*	$MBFG_{CGMS}$
$COG_{CGMS,y}$ Amount of COG used at CGMS in year y	1000 Normalized m^3	*Measured*	$MCOG_{CGMS}$
$NG_{CGMS,y}$ Amount of NG used at CGMS in year y	1000 Normalized m^3	*Measured*	MNG_{CGMS}
$V_{\sum CGMS, y}$ Arifmetic sum of individual gases consumption at CGMS in year y	1000 Normalized m^3	*calculated*	Sum of $MBFG_{CGMS}$, $MCOG_{CGMS}$ and MNG_{CGMS}
$NCV_{NG,y}$ Net calorific value NG in year y	kcal/Normalized m^3	Gas suppliers certificate	
$NCV_{Mix,SP3, PS, y}$ Net calorific value of GOG+BFG+NG mix supplied to rolling mills	kcal/Normalized m^3	calculated	
$NCV_{BFG, y}$ net calorific value of BFG	kcal/Normalized m^3	*Measured by coke plant lab; Gas volumes are converted to default 1000* kcal/Normalized m^3	
$NCV_{COG, y}$ net calorific value of COG	kcal/Normalized m^3	*Measured by BF lab; Gas volumes are converted to*	

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		default 4000 kcal/Normalized m^3	

Table 16: List of variables SP3

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

Subproject 3: Switch from NG to BFG+COG+NG mixture

Period: 2010 year			
$NG_{SP3, PS, RM3, y}$	RM#3 NG total consumption	1000 Normalized m^3	8047,419
$NG_{SP3, PS, WRRM3, y}$	WRRM#3 NG total consumption	1000 Normalized m^3	19997,572
$NG_{SP3, PS, LSRM5, y}$	LSRM#5 NG total consumption	1000 Normalized m^3	36588,321
$NG_{Dir, SP3, PS, RM3, y}$	RM#3 direct NG consumption	1000 Normalized m^3	4582,943
$NG_{Dir,SP3,PS,WRRM3,y}$	WRRM#3 direct NG consumption	1000 Normalized m^3	15459,454
$NG_{Dir, SP3, PS,LSRM5,y}$	LSRM#5 direct NG consumption	1000 Normalized m^3	30825,176
$NG_{Mix, SP3, PS, RM3,y}$	RM#3 NG consumption originated from the gas mix	1000 Normalized m^3	3464,476
$NG_{Mix, SP3, PS, WRRM3, y}$	WRRM#3 NG consumption originated from the gas mix	1000 Normalized m^3	4538,118
$NG_{Mix, SP3, PS, LSRM5, y}$	LSRM#5 NG consumption originated from the gas mix	1000 Normalized m^3	5763,145
$MIX_{SP3, PS, RM3,y}$	Total RM#3 gas mix consumption	1000 Normalized m^3	68564
$MIX_{SP3, PS, WRRM3,y}$	Total WRRM#3 gas mix consumption	1000 Normalized m^3	89812
$MIX_{SP3, PS, LSRM5,y}$	Total LSRM#5 gas mix consumption	1000 Normalized m^3	114056
$\%NG_{Mix,SP3,PS,RM3,y}$	Volumetric share of NG in gas mix	dimensionless	0,05053

.

$BFG_{CGMS, y}$	Volume of BFG used at CGMS	1000 Normalized m^3	290846
$COG_{CGMS, y}$	Volume of COG used at CGMS	1000 Normalized m^3	141281
$NG_{CGMS, y}$	Volume of NG used at CGMS	1000 Normalized m^3	22997
$V_{\sum CGMS,y}$	Total volume of gases used	1000 Normalized m^3	455124
$NCV_{NG, y}$	Net calorific value NG	kcal/Normalized m^3	8142
$NCV_{BFG, y}$	Net calorific value BFG	kcal/Normalized m^3	1000
$NCV_{COG, y}$	Net calorific value COG	kcal/Normalized m^3	4000
$NCV_{Mix,SP3, PS, y}$	Average weighted NCV of gas mixture	kcal/Normalized m^3	2292,148

Table 17: Data collected in project scenario of SP3

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

Subproject 3: Switch from NG to BFG+COG+NG mixture

Period: 2010 year			
$NG_{SP3, BS, RM3, y}$	Baseline NG consumption of RM#3	1000 Normalized m^3	23 871,352
$NG_{SP3, BS, WRRM3, y}$	Baseline NG consumption of WRRM#3	1000 Normalized m^3	40725,346
$NG_{SP3, BS, LSRM5, y}$	Baseline NG consumption of LSRM#5	1000 Normalized m^3	62 911,385
$NG_{Dir, SP3, PS, RM3, y}$	RM#3 direct NG consumption	1000 Normalized m^3	4582,943
$NG_{Dir, SP3, PS, WRRM3, y}$	WRRM#3 direct NG consumption	1000 Normalized m^3	15459,454

.

$NG_{Dir, SP3, PS, LSRM5, y}$	LSRM#5 direct NG consumption	1000 Normalized m^3	30825,176
$MIX_{SP3, PS, RM3,y}$	Total RM#3 gas mix consumption	1000 Normalized m^3	68564
$MIX_{SP3, PS, WRRM3,y}$	Total WRRM#3 gas mix consumption	1000 Normalized m^3	89812
$MIX_{SP3, PS, LSRM5,y}$	Total LSRM#5 gas mix consumption	1000 Normalized m^3	114056
$NCV_{Mix,SP3, PS, y}$	NCV of gas mix	kcal/Normalized m^3	2292,148

Table 18: Data collected for the baseline SP3

B.2.5. Data concerning leakage:

Not applicable

B.2.6. Data concerning environmental impacts:

Monitoring of environmental impacts due to operation of the plant is performed in accordance to the company standard STP 192-09-2008 named “System of environmental management. Monitoring and measurements” which conforms applicable environmental, health and safety norms of Ukraine in force. Monitoring includes the instrumental control of:

- industrial emissions caused by stationary sources;
- efficiency of operation of de-dusting and flue gas cleaning installations;
- quality of ambient air at the plant sanitary boundaries and zones of influence of different plant units;
- quality of ambient air at the places of waste removal, places where the explosive work are being carried out and also at the living districts of the city of Kryviy Rih;
- quality of sewage waters, waste waters and recycled waters;
- quality of soil at the sanitary border of AMKR and at the waste disposal areas.

Waste management is prescribed by plant standard STP 192-13-2006 which conforms to the state standard DSTU 1.5.2003 and ISO 14001:2004.

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

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In regard of data processing and archiving the Management of AMKR:

- Organizes monitoring (the appropriate orders and instructions may be issued, specifying the responsible executors, monitoring and reporting are carried out),
- Recording the required data, monitoring and reporting on the project GHG emissions at the plant
- Operation of power plant equipment,
- Recording the required data, monitoring and reporting on the project GHG emissions at the plant.
- All data archived will be kept for at least two years after the last transfer of ERUs to the client.

B.4. Special event log:

- All special events will be recorded in the shift-charge engineers' log book

There were no any special events during the monitored period.

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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 will be implemented by Mrs. Liana Maksimenko, the Director for Environment of AMKR through supervising and coordinating activities of his subordinates and other plant divisions. Her work will be supported by the assistance of Mr. Vadim Yova, the head of energy management bureau belonging to the Energy department of AMKR headed by Director for energy, Mr. Alexander Kamenev. He will be responsible for routine preparation and keeping the performance forms, which record the project variables. Within this responsibility he interacts with plant divisions in getting necessary performance data for subprojects included in the MR. The processing of metered data of consumption, pressure and temperature of gases, including of NG, COG and BFG is performed on daily basis by service for operation of control and instrumentation, headed by Mr. Alexander Omelyanets. His service is responsible for processing the circular diagrams containing daily curves of respective parameters and obtains the normalized consumption in normalized m^3. These data are transferred to respective process department and to energy department where are stored.
The plant laboratory is responsible for measurement of net calorific value (NCV) of fuels used, except for natural gas. The NCV of NG is obtained regularly from gas supplier. The process flow of data collection from primary data to reported totals is presented in a figure 6.

C.1.2. Trainings:

The management of the personnel training and retraining at the plant is carried out by the Technical Director, and the control of implementation thereof − by the Head of the enterprise.

Depending on the category of the personnel, the following methods are applied:
- Checking the knowledge of the regulations, norms and instructions related to process, labor protection, industrial and fire safety;
- On-going training and retraining.

The activity with the personnel is organized and carried out in accordance with the plans approved by the Chief Engineer of the plant that include the following:
- Entry training;
- Personnel training in second and allied professions;
- Re-training;
- Organizing the activity of the technical libraries, technical materials rooms and simulator training facilities.

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Personnel involved in monitoring process will be trained and instructed according to the MP.

C.2. Involvement of Third Parties:

The calibration of all metering equipment and accreditation of the AMKR laboratories is done by Ukrainian Centre for Standardization and Metrology and State Dnepropetrovsk regional center for standardization, metrology and certification.

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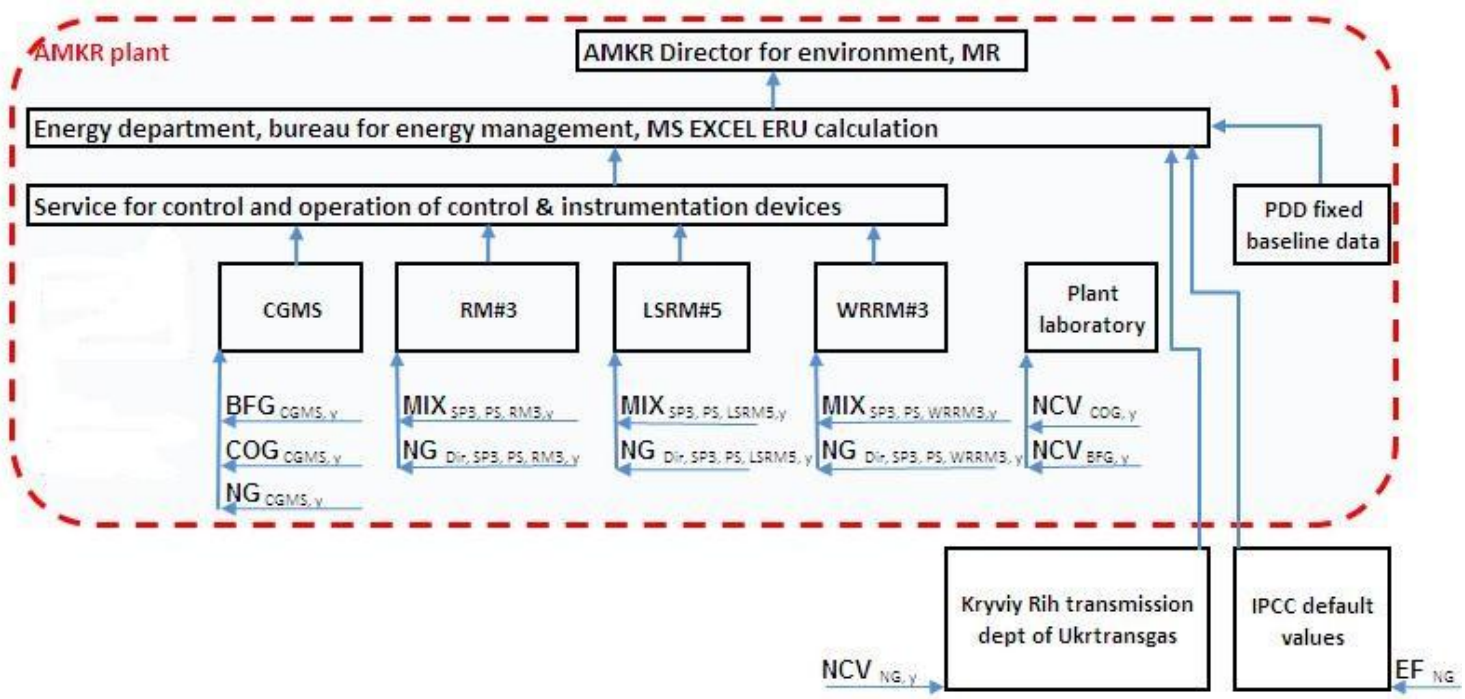

Figure 6: Data flow diagram

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C.3. Internal audits and control measures:

All metering equipment is controlled by the Instrument department of OJSC ArcelorMittal. According to the attestation certificate #06544-2-4-25/2 GOMS from 12.11.2010 issued by Ukrainian Centre for Standardization and Metrology, the Instrument department is accredited for performing of calibration of metering devices for internal needs. The certificate is valid until 12.11.2013. The service makes periodical checking and calibration of metering equipment as per approved schedule and equipment manual.

In total, AMKR uses about 70,000 measurement and instrumentation devices. This number includes thermometers, manometers, data recorders/loggers as well as power and flow meters of different type used for both, commercial and process measurement/control.

To run, maintain and calibrate this large massive of devices, a number of plant standards, procedures and manuals has been adopted:

1) In accordance to the Law of Ukraine “On metrology and metrological activities” the calibration of measurement devices using state standard DSTU 2708:2006 “Calibration of measurement equipment. Organization and routine”
2) Data base (DB) of electronic passports of measurement devices named “Accounting of measurement devices at the plant” has been developed and adopted. Operation of the DB is regulated by several manuals:
    a. UK.CIT.I.0053 manual for user of DB “Accounting of measurement devices at the plant”;
    b. UK.CIT.I.0079 manual for performing control of calibration schedules using the DB;
    c. UK.CIT.I.0066 manual for preparation of reporting using the DB;
    d. IMC.228.005-2008 manual for performing the data input in the DB.
3) Quality management system of AMKR is ISO 9003, 9002 and 9001 certified since September 1994. Last re-certification visit was conducted from 16 to 18 of May 2011 and in the result the TNO Certification, Netherlands has confirmed the compliance of quality management system to the requirement of ISO 9001:2008 “Quality management system-requirements”. Next certification visit will take place in 2012.

The responsibility of controlling the calibration procedures and operate the DB of electronic passports of metering devices is within the service of Chief Mythologist of AMKR Mr. Vladimir Drazhko.

C.4. Troubleshooting procedures:

The troubleshooting is made by maintenance mechanics or on-duty operator. The internal system requires that a broken meter has to be replaced in few hours by the Instrument department.
The Chief of Instrument dpt., Mr. V.A Drazhko is in charge with the above activities.

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SECTION D. Calculation of GHG emission reductions

D.1. Formulas used for calculations

D.1.1. Formulas used to calculate project emissions:

Subproject 3: Switch from NG to BFG+COG+NG mixture

Emissions in project scenario are the emissions due to NG consumption by RM3, WRRM#3 and LSRM#5 in form of direct consumption and consumption of NG as part of gas mix:

$$PE_{SP3,y} = \sum_i PE_{SP3,i,y} \quad \textbf{(1)}$$

Where:

$PE_{SP3, y}$	Project emissions of SP 3 in year y (tCO_2)
i	RM#3, WRRM#3 and LSRM#5
$PE_{SP3,i, y}$	Project emissions of RM#3, WRRM#3 and LSRM#5 in year y (tCO_2)

$$PE_{SP3,i,y} = NG_{SP3,PS,i,y} \times NCV_{NG,y} \times EF_{NG} \times 4.187 \div 1000 \quad \textbf{(2)}$$

Where:

i	RM#3, WRRM#3 and LSRM#5
$PE_{SP3,i, y}$	Project emissions of RM#3, WRRM#3 and LSRM#5 in year y (tCO_2)
$NG_{SP3, PS, i, y}$	Total (direct and indirect (with gas mix)) NG consumption of RM#3, WRRM#3 and LSRM#5 in year y (1000 Normalized m^3)
$NCV_{NG, y}$	NCV of NG in year y (kcal/m^3)
EF_{NG}	Carbon emission factor of NG (tCO_2/GJ)
4.187/1000	Unit conversion factor from kcal/Normalized m^3 to GJ/1000 Normalized m^3

The total NG consumption of RM#3, WRRM#3 and LSRM#5 in year y is calculated as follows:

$$NG_{SP3,PS,i,y} = NG_{Dir,SP3,PS,i,y} + NG_{MIX,SP3,PS,i,y} \quad \textbf{(3)}$$

.

Where:

i	RM#3, WRRM#3 and LSRM#5
$NG_{Dir, SP3, PS, y}$	Direct NG consumption in year y by RM#3, WRRM#3, LSRM#5 (1000 Normalized m^3)
$NG_{MIXir, SP3, PS, y}$	Consumption of NG by RM#3, WRRM#3, LSRM#5 as part of gas mix in year y (1000 Normalized m^3)

The NG consumption by RM#3, WRRM#3 and LSRM#5 as a part of gas mix is calculated as follows:

$$NG_{MIX,PS,i,y} = MIX_{SP3,PS,i,y} \times \%NG_{MIX,SP3,PS,y} \quad \textbf{(4)}$$

Where:

i	RM#3, WRRM#3 and LSRM#5
$MIX_{SP3, PS, i, y}$	BFG+COG+NG gas mix consumption of rolling mill i in year y (1000 Normalized m^3)
$\%NG_{MIX, SP3, PS, y}$	Volumetric share of NG in gas mix supplied to all RMs from CGMS (dimensionless)

Gas mix is prepared at the central gas mixing station from COG, BFG and NG where the volumes of these three gases are measured. Then the mix is supplied to all rolling mills therefore the composition of mix and share on NG in it for all of them will be the same.
To calculate the share of NG in the gas mix the measured annual volumes of individual gases are used:

$$\%NG_{MIX,PS,y} = NG_{CGMS,y} \div V_{\sum CGMS,y} \quad \textbf{(5)}$$

Where:

$NG_{CGMS, y}$	Consumption of NG by CGMS in year y (1000 Normalized m^3)
$V_{\sum CGMS, y}$	Sum of COG, BFG and NG consumptions at CGMS (1000 Normalized m^3)

The sum of gases consumptions is calculated as arithmetic sum of NG, COG and BFG consumptions at CGMS as shown below:

$$V_{\sum CGMS,y} = NG_{CGMS,y} + COG_{CGMS,y} + BFG_{CGMS,y} \quad \textbf{(6)}$$

Where:

$NG_{CGMS, y}$; $COG_{CGMS, y}$ and **$BFG_{CGMS, y}$** are the consumptions at the CGMS of the individual gases in year y (1000 Normalized m^3)

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D.1.2. Formulas used to calculate baseline emissions:

Subproject 3: Switch from NG to BFG+COG+NG mixture

Emissions of SP3 in the baseline are calculated using the following equations:

$$BE_{SP3,y} = \sum_i BE_{SP3,i,y} \quad \textbf{(7)}$$

Where:

$BE_{SP3,\ y}$	Baseline emissions of SP 3 in year y (tCO_2)
$BE_{SP3,i,y}$	Baseline emissions of RM#3, WRRM#3 and LSRM#5 in year y ($tCO_{2)}$
i	RM#3, WRRM#3 and LSRM#5

$$BE_{SP3,i,y} = NG_{SP3,BS,i,y} \times NCV_{NG,y} \times EF_{NG} \times 4.187 \div 1000 \quad \textbf{(8)}$$

Where:

$BE_{SP3,I,\ y}$	Baseline emissions of RM#3, WRRM#3 and LSRM#5 in year y (tCO_2)
$NG_{SP3,\ BS,\ i,\ y}$	Baseline NG consumption of RM i in year y (1000 Normalized m^3)
i	RM#3, WRRM#3 and LSRM#5
$NCV_{NG,\ y}$	NCV of NG in year y (kcal/m^3)
EF_{NG}	Carbon emission factor of NG (tCO_2/GJ)
4.187/1000	Unit conversion factor from kcal/Normalized m^3 to GJ/1000 Normalized m^3

In the baseline, only NG is used to cover the heat demand of SP3 which in the project scenario is covered by all three gases. Therefore the heat content of gas mix in the baseline shall be recalculated using NG NCV to the baseline volume of NG:

$$NG_{SP3,BS,i,y} = \frac{(NG_{Dir,SP3,PS,i,y} \times NCV_{NG,y} + MIX_{SP3,PS,i,y} \times NCV_{MIX,SP3,PS,y})}{NCV_{NG,y}} \quad \textbf{(9)}$$

.

Where:

$NG_{Dir, SP3, PS, i, y}$	Direct NG consumption in by rolling mill i year y (1000 Normalized m^3)
i	RM#3, WRRM#3 and LSRM#5
$NCV_{NG, y}$	NCV of NG in year y (kcal/m^3)
$MIX_{SP3, PS, i, y}$	BFG+COG+NG gas mix consumption of RM i in year y (1000 Normalized m^3)
$NCV_{MIX, SP3, PS, y}$	Net calorific value of gas mix supplied to all RMs from CGMS in year y (kcal/m^3)

The net calorific value of the gas mix prepared at CGMS is calculated as weighted average by their calorific values of volumes of individual gases supplied to CGMS as shown in equation below:

$$NCV_{MIX,SP3,PS,y} = \frac{(NG_{CGMS,y} \times NCV_{NG,y} + COG_{CGMS,y} \times NCV_{COG,y} + BFG_{CGMS,y} \times NCV_{BFG,CGMS,y})}{V_{\sum CGMS,y}} \quad \textbf{(10)}$$

Where:

$NG_{CGMS, y}$; $COG_{CGMS, y}$ and $BFG_{CGMS, y}$	Consumptions at the CGMS of the individual gases in year y (1000 Normalized m^3)
$NCV_{COG, y}$; $NCV_{BFG, y}$	Net calorific values of COG and BFG (kcal/m^3)
$V_{\sum CGMS, y}$	Sum of COG, BFG and NG consumption at CGMS (1000 Normalized m^3) as defined by equation (6).

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D.1.3. Formulas used to calculate emission reductions:

Subproject 3: Switch from NG to BFG+COG+NG mixture

$$ER_{SP3,y} = BE_{SP3,y} - PE_{SP3,y} \quad (11)$$

Where:

$ER_{SP3, y}$	Emission reduction of the SP3 in year y (tCO_2e)
$BE_{SP3, y}$	Baseline emissions of SP3 in year y (tCO_2e)
$PE_{SP3, y}$	Project emissions in year of SP3 in year y (tCO_2e)

Resulting emission reduction for 2010 is the emission reduction of subproject SP3:

$$ER_y = ER_{SP3,y} \quad (12)$$

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

All measurement uncertainties and error propagation are according to the passports of measuring equipment and the calibration certificates.

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

D.3.1. Project emissions:

Subproject 3: Switch from NG to BFG+COG+NG mixture

PE of SP3

Monitoring period [year]		**2010**
Project emissions (PE)	[tCO_2e]	**123 610**

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D.3.2. Baseline emissions:

Subproject 3: Switch from NG to BFG+COG+NG mixture

BE of SP3

Monitoring period [year]		**2010**
Baseline emissions (BE)	[tCO_2e]	**243 857**

D.3.3. Leakage:

N.A.

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

Subproject 3: Switch from NG to BFG+COG+NG mixture

ER of RM#3+WRRM#3+LSRM#5

Monitoring period [year]		**2010**
Emission reductions (ER)	[tCO_2e]	**120 247**

ER 2010

Total amount of ER generated in 2010

Monitoring period [year]		**2010**
Emission reductions (ER)	[tCO_2e]	**120 247**

.

Annex 1

Definitions and acronyms

Acronyms and Abbreviations:

ERU	Emission Reduction Units
CO_2	Carbon Dioxide
GHG	Greenhouse Gases
GJ	Gigajoule
IPCC	Intergovermental Panel on Climate Change
MWH	Megawatt Hour
PDD	Project Design Document
WRRM	Wire rod rolling mill
LSRM	Light-section rolling mill
RM	Rolling mill
CGMS	Central gas mixing station (mixing of NG, COG and BFG for use at RMs)
SP1...SP8	Subprojects 1 to 8

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Definitions:

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 emission reduction or sequestration projects that generate Emission 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).
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.
Emission reductions	Emission 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 (CO2), Methane (CH4), Nitrous Oxide (N2O), Hydrofluorcarbons (HFCs), Perfluorcarbons (PFCs) and Sulphurhexafluoride (SF6).

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