MONITORING REPORT

JI0105 - CMM utilisation on the Joint Stock Company "Coal Company Krasnoarmeyskaya-Zapadnaya № 1 Mine"

Monitoring Report 05
Monitoring period
01/05/2012 to 31/12/2012

Version 4
24 April 2013

CONTENTS

Annexes

SECTION A. General project activity information

A.1 Title of the project activity:

CMM utilisation on the Joint Stock Company “Coal Company Krasnoarmeyskaya-Zapadnaya № 1 Mine”

Party involved (*) ((host) indicates a host Party)	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (host)	«Colliery Group «Pokrovs’ke»[1]	no
Netherlands	Carbon-TF B.V.	no

A.2. JI registration number:

UA2000016 / JI0105
The project is approved as JI-project since 09/11/2009.
(http://ji.unfccc.int/JI_Projects/DeterAndVerif/Verification/FinDet.html)

Details of the project approval can be found under Annex I of this Monitoring Report.

A.3. Short description of the project activity:

In this project CMM, which has been sucked out of the active coal mine «Colliery Group «Pokrovs’ke», has been utilised in a previous coal boiler, which has been upgraded with a CMM burning system, a flare and six cogeneration units at the main shaft. The methane has been burned to less harmful CO_2.

In this monitoring the gained emission reductions should be monitored for the purpose of the verification as Emission Reductions Units (ERU).

During current monitoring period the CMM boiler, flare and five cogeneration units were in operation. The boiler and flare worked until November and then stopped because of lack of gas amount.

Table-1 Amount of methane utilised for heat and power generation and flaring

period	CH_4 [m³]	Heat generated [MWh]	Power generated [MWh]	Methane utilised by flaring [t CH4]
01/05/2012 - 31/12/2012	14,618,166	7,774	42,401	843

A.4. Monitoring period:

Start date 01/05/2012

End date 31/12/2012

Start day and end day included.

[1] The name of the coal mine changed to «Colliery Group «Pokrovs’ke», see Section A.7. for justification

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

A.5.1. Baseline methodology:

The approved consolidated methodology ACM0008 / Version 03 "Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring" has been used to identify the baseline scenario of the proposed JI project [ACM0008].

According to ACM0008 the methodological “Tool to determine project emissions from flaring gases containing methane”, EB 28 Meeting report, Annex 13, has been taken for the determination of the project emissions from flaring. But in difference to this methodological tool a combustion efficiency of 99.5%, according to the IPCC guidelines (see also ACM0008 Version 1 and Version 2), has been taken into account instead of the default value of 90% as given in the tool.

A.5.2. Monitoring methodology:

A monitoring plan provided by the “Approved consolidated baseline methodology ACM0008”, Version 03, Sectoral Scope: 8 and 10, EB28 is applied to the project [ACM0008].

Applicability requirements for the monitoring plan of the ACM0008 methodology are identical to respective requirements of the baseline setting.

According to ACM0008 the methodological “Tool to determine project emissions from flaring gases containing methane”, EB 28 Meeting report, Annex 13, has been taken for the determination of the project emissions from flaring. In difference to this methodological tool a combustion efficiency of 99.5%, according to the IPCC guidelines (see also ACM0008 Version 1 and Version 2), has been taken into account instead of the default value of 90% as given in the tool.

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

The project has not been installed as planned in the PDD. In the monitoring period only the installation at the main shaft has been completed. The installation of further units at the air shaft as stated in the PDD took not place due to the lack of funds.

The coordinates given in the PDD uses the SK-42 reference system which uses a slightly different reference ellipsoid than the WGS84 (World Geodetic System) system used by Google. The SK-42 system and the substantial cartography are still in use in the most CIS countries and Ukraine too.

The WGS84 coordinates are:

Central Shaft: 48°15’31’’ N, 36°59’30’’ E
Air Shaft: 48°15’20’’ N, 37°01’57’’ E

Table-2 Status of Implementation

Unit: upgraded previously coal fired steam boiler at central shaft
Manufacturer: Biysk Boiler Plant
Type: KE-25-14KC

Serial Number: 6827 (not visible)	
Inventar Number: 4022 (visible)	
Capacity: 25 t/h steam (approx. 25 MW)	
Activity	**Status**
year of construction	06/05/1986
last major overhaul	22/12/2002 - Ukrteploservis
Last inspection	15/03/2011 - Derzhgorpromnadzor
Commission of upgrade	20/03/2003
Official completion of upgrade	31/03/2003
Start of initial operation, first tests	summer 2003
Start of operation	October 2003
Planned installation date [PDD]	October 2003

Unit: Flare 1	
Manufacturer: Hofstetter Umwelttechnik AG	
Type: HOFGAS®-IFL4c 9000	
Serial Number:H 10244	
Capacity: max. 9,000 m³/h gas (20-40% CH_4), max 25 MW firing capacity	
Activity	**Status**
Year of construction	2008
Last inspection	2010, Sinapse
Commission date	26/10/2010
Start of operation	October 2010
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 1	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 4590982	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2006
Last inspection	2011, Jenbacher
Commission date	-
Start of operation	-
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 2	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 4533481	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2006

Last inspection	2011, Jenbacher
Commission date	December 2011, Jenbacher
Start of operation	December 2011
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 3	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 4590981	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2006
Last inspection	2012, Jenbacher
Commission date	December 2011 (Jenbacher), March 2012 (Sinapse)
Start of operation	December 2011
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 4	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 4934371	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2007
Last inspection	2012, Jenbacher
Commission date	October 2011 (Jenbacher), January 2012 (Sinapse)
Start of operation	October 2011
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 5	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 4533482	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2006
Last inspection	2011, Jenbacher
Commission date	June 2012 (Jenbacher), June 2012 (Sinapse)
Start of operation	June 2012
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 6
Manufacturer: GE Jenbacher GmbH & Co.KG
Type: JMS 620 GS-L
Serial Number: 5841531

Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2008
Last inspection	2011, Jenbacher
Commission date	December 2011 (Jenbacher), February 2012 (Sinapse)
Start of operation	December 2011
Planned installation date [PDD]	January 2008

For cogeneration units two commission dates are shown because the initial starting-up adjustment of the cogenerations units was made by the representatives of the manufacturer (Jenbacher) while the commissioning was made by company Sinapse which is responsible for service of measuring equipment of the units for monitoring.

Table-3 Installation plan [PDD] –original and updated timeline

unit	**installation date (PDD)**	**firing capacity**	**planned installation new timetable**
Central Shaft			
upgraded boiler	Oct 2003	25 MW	October 2003
flare No: 1	Jan 2008	5 MW	1 Flare with 25 MW in October 2010
flare No: 3	Mar 2008	5 MW	Included above
cogeneration units	Jul 2008	total of 48.8 MW	October 2011
Degassing wells			
flare/pump No: 2	Jan 2008	5 MW	not installed
flare/pump No: 7	Apr 2008	5 MW	not installed
Air Shaft № 2			
flares No: 4-6	Apr 2008	total of 15 MW	not installed
cogeneration units	Jun-Oct 2008	total of 67.5 MW	not installed
cogeneration units	Jan 2009	total of 30 MW	not installed

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

There are some differences between the determined PDD and implemented project. The conditions defined by paragraph 33 of the JI guidelines are still met for the project.

- The physical location of the project has not changed.
- The emission sources have not changed.
- The baseline scenario has not changed.
- The changes are consistent with the JI specific approach and CDM methodology upon which the determination was prepared for the project.

The differences of the project installation as described in the PDD and the implemented project are listed in the table below.

unit	**difference**	**justification**
flares No: 1 & 3	delay	The installation of the flares was delayed due to lacking funds due to delayed project registration.

flares No: 1 & 3	changed number of flares, change capacity firing capacity 25 MW instead of 10 MW	In the PDD two flares with a capacity of 5 MW (total of 10 MW) each were given. The installed flare has a capacity of up to 25 MW. The bigger flare has been offered by the contractor of the CHP units – Sinapse. The coal mine decided to buy one bigger flare instead of two smaller, because of organising and technical factors: - design, delivery and mounting of flare unit (as of all equipment for Cogeneration Station) is made by one contractor; - compact size of the unit; - utilisation volume of the air-methane mixture of 1 unit HOFGAS exceeds in two times similar rates of two 5 MWt flares, which primarily were foreseen in PDD.
flares No: 2 & 4-7	not installed	The flares have not been installed due to lacking funds.
cogeneration units at Central Shaft	delay	The installation of the cogeneration units at the main shaft was delayed due to lacking funds.
cogeneration units at Air Shaft	not installed	The cogeneration units at Air Shaft have not been installed due to lacking funds.

The name of the Coal Mine has been changed per 07/09/2010.
The old name "Joint Stock Company "Coal Company Krasnoarmeyskaya-Zapadnaya No 1 Mine"" is no longer valid, the new name is:

"Public Joint Stock Company «Colliery Group «Pokrovs'ke»"

The identifying number and domicile of the legal entity as well as the place of registration remain unchanged.
The change of name has been reported to JISC. JISC has decided that the title of the project 105 registered in the JI Information system cannot be changed and the title of the project will keep the old name of the company.

There were no deviations or revisions to PDD during current monitoring period.

A.8. Intended adjustments or revisions to the registered monitoring plan:

A8.1 Deviations determined during first monitoring period

The calculation of the emission reductions is not calculated on a yearly basis, but for an individual period. Flow data and flare efficiency as well as the methane amount destroyed by flaring MD_{Fl} are calculated in 15 min. intervals in Excel sheets. The main emissions variables for project emissions, baseline emissions and emissions reductions are calculated on a monthly basis. Yearly sums and a total sum for the monitoring are calculated.

A8.1.1 Project emissions from flaring

The formula for the calculation of project emissions from uncombusted methane has been updated. The calculation of project emissions from uncombusted methane from flaring are now more accurate.

In the PDD the formula for project emissions from uncombusted methane is given as per:

$$PE_{UM} = GWP_{CH4} \times [(MM_{FL} \times (1 - Eff_{FL}) + MM_{ELEC} \times (1 - Eff_{ELEC}) + MM_{HEAT} \times (1 - Eff_{HEAT})] \quad (9) \text{ old}$$

In the revised monitoring plan the formula (9) has been replaced by the following formula:

$PE_{UM} = GWP_{CH4} \times [MM_{ELEC} \times (1 - Eff_{ELEC}) + MM_{HEAT} \times (1 - Eff_{HEAT})] + PE_{Flare}$ (9) new

PE_{Flare} is calculated using adopted formulae from the «Methodological "Tool to determine project emissions from flaring gases containing methane"» [AM_Tool_07] and ACM0008 Version 03. The original formulae refers to a yearly basis. The formulae have been adapted in the revised monitoring plan to variable monitoring periods:

The original formulae are:

$$PE_{Flare} = \sum_{i=1}^{n} TM_{RG,i} x (1 - \eta_{flare,i}) x \frac{GWP_{CH4}}{1000} \quad (9a)$$

where:

PE_{Flare}	Project emissions from flaring in the regarded period (t CO_2eq)
$TM_{RG,i}$	Mass flow rate of methane in the regarded interval i (kg/interval)
$\eta_{flare,i}$	flare efficiency in the interval i
GWP_{CH4}	Global warming potential of methane (21 tCO_2eq/tCH_4)
n	number of samples (intervals) in the regarded period

and

$MD_{FL} = MM_{FL} – (PE_{Flare}/GWP_{CH4})$ (5)

where:

MD_{FL}	Methane destroyed through flaring in the regarded period (t CH_4)
MM_{FL}	Methane sent to flaring in the regarded period (t CH_4)
PE_{Flare}	Project emissions from flaring in the regarded period (t CO_2eq)
GWP_{CH4}	Global warming potential of methane (21 tCO_2eq/tCH_4)

In the revised monitoring plan and this monitoring report, formulae 9a and 5, see above have been resolved to fit better to the monitored data.

The project emissions from flaring are calculated using the equation:

$PE_{Flare} = (MM_{Fl} - MD_{FL}) * GWP_{CH4}$ (9a)

where:

PE_{Flare}	Project emissions from flaring in the regarded period (t CO_2eq)
MD_{Fl}	Methane destroyed through flaring (t CH_4)
MM_{Fl}	Methane measured sent to flaring (t CH_4)
GWP_{CH4}	Global warming potential of methane (21 tCO_2eq/tCH_4)

The formula for the methane destroyed through flaring is:

$$MD_{FL} = \sum_{i=1}^{n} MM_{FL,i} x \eta_{flare,i} \quad (5)$$

where:

MD_{FL}	Methane destroyed through flaring (t CH_4)
$MM_{FL,i}$	Methane sent to flaring in the interval i (t CH_4)
$\eta_{flare,i}$	Efficiency of methane destruction/oxidation in flare in the interval i, see below
n	number of samples (intervals) in the regarded period

The interval is set to 15 min during the monitoring period, which is more accurate than the 1 h intervals from the «Methodological “Tool to determine project emissions from flaring gases containing methane”» [AM_Tool_07])

For $\eta_{flare,i}$ three different values are taken, depending on the current combustion temperature $T_{Flame,i}$ of the flare in the interval i:

$T_{Flame,i}$	$\eta_{flare,i}$	Source
> 1000°C*)	99.5%	revised monitoring plan Section D.1.1 and Annex 2
500-1000°C*)	90.0%	[AM_Tool_07-15]
< 500°C	0%	[AM_Tool_07-15]

*) in the original monitoring plan in the PDD a value of 850°C instead of 1000°C was given. The value has been changed according to the requirements of the manufacturer.

where:

$T_{Flame,i}$ Flame temperature of the flare in the regarded interval i (°C)

$\eta_{flare,i}$ flare efficiency in the interval i

A8.2 Deviations determined during fourth monitoring period

New source for CO_2 emission factor of the grid was taken. As official Ukrainian data have been published by national authority per 12/05/2011, new values for thermal power plants which are connected to the Ukrainian Power grid have been taken into account.

New source for CO_2 emission factor of fuel used for captive power or heat was taken. The factor is now calculated using the value for “Other Bituminous Coal” of 25.87 t C/TJ from “National Inventory Report of Anthropogenic Emissions from Sources and Absorption by Absorbers of Greenhouse Gases in Ukraine for 1990-2009” Baseline carbon emission factor for other bituminous coal approved in Ukraine.

A8.3 Deviations determined during current monitoring period

Source for CO2 emission factor of fuel used for captive power or heat was updated. The value of the factor was changed. Now it’s calculated using the value for “Bituminous Coal” of 25.99 t C/TJ from “National Inventory Report of Anthropogenic Emissions from Sources and Absorption by Absorbers of Greenhouse Gases in Ukraine for 1990-2010”.

A.9. Changes since last verification:

In June the cogeneration module # 5 started operation so in total five working modules of cogeneration units were in operation during current monitoring period.

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

«Colliery Group «Pokrovs’ke»

- Volodymyr Tymchenko, Technical Director since February 2010

Carbon-TF B.V

- Dr. Jürgen Meyer, Managing Director
- Clemens Backhaus, Managing Director

Eco-Alliance
- Vladimir Kasyanov, Managing director
- Pavel Shelegeda, Deputy Director
- Aleksandr Didenko, Monitoring Assistant
- Viktor Avtonomov, Monitoring Assistant

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

B.1. Monitoring equipment:

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):

Table-4 Monitoring equipment

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
2a	CH_4 concentration	Infrared measurement	POLITRON - Draeger	Gas analyzer	ARSK 0191	measurement continuous record period 15 min.	2002	0-100 %	4% absolute error in the range below 40% LEL**) 10% relative error in the range above 40% LEL**)	Yearly calibration made using procedures of Sumystandart-metrology. Calibrations made using procedures of Eco Alliance every 2 weeks.	10/2011 10/2012	
3	NMHC concentration	lab analysis	Chromatograph	3700 L	279	yearly	unknown	$1\text{-}5*10^{-4}$%	10% for upper range limit 25% for lower range limit	The approved laboratory is responsible for regular recalibrations of the system.	unknown	Donetskstandartmetrology
4	CMM amount to boiler	Vortex flow meter	"Sibnefteavtomatika" IJSC, Tyumen, Russia	DRG.MZ-300	06136	measurement continuous record period 15 min.	Sep 2009	562.5-22,500 m³/h	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*)	Calibration made using procedures of the manufacturer. Calibration frequency – 3 years	18/12/2012	Manufacturer
5	CMM pressure (boiler)	Ceramic pressure pick-up	Siemens	SITRANS P Serie Z	AZB/W 5132862	measurement continuous record period 15 min.	Sep 2009	0-1.6 bar, abs	0.5%)	Calibration made using procedures of the manufacturer. Calibration	09/12/2011 18/10/2012	Sumystandart-metrology

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										frequency – 1 year		
6	CMM temperature (boiler)	Resistance thermometer	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0.5% 80F8	09455 from 15/05/2012	measurement continuous record period 15 min.	Sep 2009 May 2012	-50-250°C	0.5%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	17/10/2012	Sumystandart -metrology
7	Steam amount to boiler	Vortex flow meter	"Sibnefteavto matika" IJSC, Tyumen, Russia	DRG.MZ-200	06135	measurement continuous record period 15 min.	Sep 2009	250-10,000 m³/h	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*))	Calibration made using procedures of the manufacturer. Calibration frequency – 3 years	30/04/2009	Manufacturer
8	Steam pressure (boiler)	Ceramic pressure pick-up	Siemens	SITRANS P Serie Z	AZB/A2199938	measurement continuous record period 15 min.	Jan. 2011	0-10 bar, abs	0.5%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	09/12/2011 18/10/2012	Manufacturer
9	Steam Temperature (boiler)	Resistance thermometer	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5% 80F8	09436	measurement continuous record period 15 min.	Oct. 2010	-50-250°C	0.5%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	07/11/2011 17/10/2012	Sumystandart -metrology
10	CMM amount to flare	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14033	measurement continuous record period 15 min.	Aug. 2011	n.a	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	For unit 14033: 26/04/2011	Manufacturer
11	CMM amount to flare	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG MZL 200-400	10144	measurement continuous record period 15 min.	Oct. 2010	2,000-40,000 m³/h	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*))	Calibration made using procedures of the manufacturer. Calibration	20/07/2010 By manufac-turer	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										frequency – 3 years		
12	CMM pressure (flare)	Pressure transmitter	Metran	Metran 150TG2	932847	measurement continuous record period 15 min.	Oct. 2010	0... 60 kPa	0.25%	Calibration made using procedures of the manufacturer. Calibration frequency – 4 years	05/08/2010 By manufac-turer	Manufacturer
13	CMM pressure (flare)	Measuring Transformer	VEGA Grieshaber KG	Vegabar 17 KG	20108320	measurement continuous record period 15 min.	Aug. 2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	13/04/2011 By manufacture r 05/2012	Manufacturer
14	CMM Temperature	Measuring Transformer	Microterm	MTM201D	3401	measurement continuous record period 15 min.	Oct. 2010	-50 - 100°C	0.25 %	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	30/10/2012	Donetskstand-artmetrology
15	CH_4 Concentration	Infrared measurement	NUK	NGA5 CH_4/O_2	4009.87*	measurement continuous record period 15 min.	Oct. 2010 Sept. 2012**	0...100% CH_4 0...25% O_2	2 %	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	28/10/2011 11/06/2012 by manufacture r	Donetskstand-artmetrology
16	Electricity	Electricity meter	Actaris	SL7000 Type – SL761E071	53024005	Continuous, cumulative value Read period monthly	Oct. 2010	n.a	0.5%	Initial calibration made by manufacturer. Calibration is spent 1 time in 6 years	By manufacture r	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
17	Flare Temperature	Thermo couple	Energoterm Jumo	TPP-401M	436-11 5295-00 from 17/08/2012	measurement continuous record period 15 min.	Aug. 2011 Aug. 2012	0… 1300°C	1.5%	none, thermocouple is supposed to be changed at least one time per year, according to the flaring tool	changed every year	none
18	CMM amount to Cogeneration Unit #1 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14045	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
19	CMM amount to Cogeneration Unit #1 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14032	measurement continuous record period daily	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
20	CMM amount to Cogeneration Unit #1 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12057**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
21	CMM amount to Cogeneration Unit #1 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10567	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
22	CMM pressure Cogeneration Unit #1 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1770	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
23	CMM pressure Cogeneration Unit #1 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1783	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
24	CMM Temperature Cogeneration Unit #1 (main gas)	Measuring Transformer	Microterm	MTM201D	3687	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
25	CMM Temperature Cogeneration Unit #1 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3685	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
26	CMM amount to Cogeneration Unit #2 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14043	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
27	CMM amount to Cogeneration Unit #2 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12054**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										– 3years		
28	CMM amount to Cogeneration Unit #2 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10571**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
29	CMM pressure Cogeneration Unit #2 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1771	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
30	CMM pressure Cogeneration Unit #2 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1779	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
31	CMM Temperature Cogeneration Unit #2 (main gas)	Measuring Transformer	Microterm	MTM201D	3691	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
32	CMM Temperature Cogeneration Unit #2 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3681	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
33	CMM amount to Cogeneration Unit #3 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14041	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration	26/04/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										frequency – 3years		
34	CMM amount to Cogeneration Unit #3 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14037	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
35	CMM amount to Cogeneration Unit #3 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12059	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
36	CMM amount to Cogeneration Unit #3 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10560**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
37	CMM pressure Cogeneration Unit #3 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1767	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
38	CMM pressure Cogeneration Unit #3 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1782	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
39	CMM Temperature Cogeneration Unit #3 (main gas)	Measuring Transformer	Microterm	MTM201D	3692	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
40	CMM Temperature Cogeneration Unit #3 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3683	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
41	CMM amount to Cogeneration Unit #4 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14034	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
42	CMM amount to Cogeneration Unit #4 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14036	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
43	CMM amount to Cogeneration Unit #4 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12056**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
44	CMM amount to Cogeneration Unit #4 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	11185**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
45	CMM pressure Cogeneration Unit #4 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1766	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
46	CMM pressure Cogeneration Unit #4 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1780	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
47	CMM Temperature Cogeneration Unit #4 (main gas)	Measuring Transformer	Microterm	MTM201D	3688	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
48	CMM Temperature Cogeneration Unit #4 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3686	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
49	CMM amount to Cogeneration Unit #5 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14040	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency	26/04/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										– 3years		
50	CMM amount to Cogeneration Unit #5 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14044	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
51	CMM amount to Cogeneration Unit #5 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12053**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
52	CMM amount to Cogeneration Unit #5 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	11193**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
53	CMM pressure Cogeneration Unit #5 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1769	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
54	CMM pressure Cogeneration Unit #5 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1781	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
55	CMM Temperature Cogeneration Unit #5 (main gas)	Measuring Transformer	Microterm	MTM201D	3689	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
56	CMM Temperature Cogeneration Unit #5 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3684	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
57	CMM amount to Cogeneration Unit #6 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14042	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
58	CMM amount to Cogeneration Unit #6 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14035	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
59	CMM amount to Cogeneration Unit #6 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12061**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
60	CMM amount to Cogeneration Unit #6 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10558**	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max} *))	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
61	CMM pressure Cogeneration Unit #6 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1768	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
62	CMM pressure Cogeneration Unit #6 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1784	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
63	CMM Temperature Cogeneration Unit #6 (main gas)	Measuring Transformer	Microterm	MTM201D	3690	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
64	CMM Temperature Cogeneration Unit #6 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3682	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011 08/05/2012	Manufacturer
65	Electricity	Electricity meter	Elster Metronica	A1800	01226171	measurement continuous	2011	0,8 U_{nom} - 1,2 U_{nom}	Accuracy class 0,2S; 0,5S; 1; 2 for active energy and 0,5; 1,0; 2,0;	Calibration made using procedures of the manufac-turer. Calibration frequency	16/06/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
									2,0 for reactive energy	– 12 years		
66	Electricity (own needs)	Electricity meter	Telecart	Energy-9	53917	measurement continuous	2011	0,8 U_{nom} - 1,2 U_{nom} 0,01 I_{nom} – I_{max}	Accuracy class 0,2; 0,5; 1,0 for active energy and 0,5; 1,0; 1,0 for reactive energy	Calibration made using procedures of the manufac-turer. Calibration frequency – 6 years	04/10/2010	Manufacturer
67	Electricity (own needs)	Electricity meter	Telecart	Energy-9	53941	measurement continuous	2011	0,8 U_{nom} - 1,2 U_{nom} 0,01 I_{nom} – I_{max}	Accuracy class 0,2; 0,5; 1,0 for active energy and 0,5; 1,0; 1,0 for reactive energy	Calibration made using procedures of the manufac-turer. Calibration frequency – 6 years	04/10/2010	Manufacturer
68	Heat	Heat meter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	STS.M (+BKT.M)	13984	measurement continuous	2011	d 25-1000 mm 0÷1,6 MPa t -45-50°C	1,5%	Calibration made using procedures of the manufac-turer. Calibration frequency – 3 years	19/04/2011	Manufacturer
69	Heat	Flow meter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRS-100 M	8022	measurement continuous	2011	3-100 m^3/h	1,5%	Calibration made using procedures of the manufac-turer. Calibration frequency – 3 years	25/11/2010	Manufacturer
70	Heat	Flow meter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRS-100 M	12047	measurement continuous	2011	3-100 m^3/h	1,5%	Calibration made using procedures of the manufac-turer. Calibration frequency	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										– 3 years		
71	Heat	Measuring transformer	JSC “Tera”, Chernigov	TSPU 1-3-Pt-100	11618	measurement continuous	2011	0-150°C	0.2%	Calibration made using procedures of the manufac-turer. Calibration frequency – 2 years	19/05/2011	Manufacturer
72	Heat	Measuring transformer	JSC “Tera”, Chernigov	TSPU 1-3-Pt-100	11617	measurement continuous	2011	0-150°C	0.2%	Calibration made using procedures of the manufac-turer. Calibration frequency – 2 years	19/05/2011	Manufacturer
73	Heat (own needs)	Heat meter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	STS.M (+BKT.M)	13982	measurement continuous	2011	d 25-1000 mm 0÷1,6 MPa t -45-50°C	1,5%	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	15/04/2011	Manufacturer
74	Heat (own needs)	Flow meter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRS-100 M	12022	measurement continuous	2011	3-100 m^3/h	1,5%	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	25/11/2010	Manufacturer
75	Heat (own needs)	Measuring transformer	JSC “Tera”, Chernigov	TSPU 1-3-Pt-100	11619	measurement continuous	2011	0-150°C	0.2%	Calibration made using procedures of the manufac-turer. Calibration frequency – 2 years	19/05/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
76	Heat (own needs)	Measuring transformer	JSC “Tera”, Chernigov	TSPU 1-3-Pt-100	11622	measurement continuous	2011	0-150°C	0.2%	Calibration made using procedures of the manufac-turer. Calibration frequency – 2 years	19/05/2011	Manufacturer

Note: Changes during fourth monitoring period

* - In previous MR not the serial number of meter was indicated but the number of certificate

** - In previous MR there were copy/paste errors in indicating these numbers, now they are set in order.

Measurement equipment for heat produced by cogeneration station was added (positions 68-76)

*) The velocities are always in the specified range. The velocities correspond to the following gas flows:

ID 4 CMM flow:	Q_{min} = 562.5 m³/h,	Q_{max} = 22,500 m³/h
ID 7 steam flow:	Q_{min} = 250.0 m³/h,	Q_{max} = 10,000 m³/h
ID 10 CMM flow	Q_{min} = 1,000 m³/h,	Q_{max} = 40,000 m³/h

**) The Draeger Politron is mainly a CH_4 detection and warning system, which is normally utilised for the determination of dangerous methane concentrations up to the lower explosion limit LEL, for the avoidance of explosions. The analyser is designed and optimized for the exact determination of low methane concentrations. Despite that the range of the meter can be extended to the range of 0-100% CH_4 according to the Draeger manual.

The conversion of the errors from LEL to % CH_4 in the gas mixture gives the following values:

Table-5 Uncertainty levels of the Draeger Politron

Range	Range	Uncertainty	Uncertainty
< 40% LEL	< 2% CH_4	4% absolute of LEL	0.2 % CH_4 absolute
> 40% LEL	> 2% CH_4	10% relative	Linear error increase starting with 0.2 % CH_4 abs at 2% CH_4 concentration Ending with 10% CH_4 abs at 100% CH_4

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

B.2.1. List of fixed default values:

Table-6 List of ex-ante fixed values

ID number	Data variable	Source of data	Data unit	Comment
P13 Eff_{FL}	Flare combustion efficiency	revised monitoring plan	%	Set to: 99.5 % for $T_{flare} > 1.000°C$ 90.0 % for $500°C < T_{flare} < 1.000°C$ 0.0 % for $T_{flare} < 500°C$
P16 Eff_{ELEC}	Efficiency of methane destruction / oxidation in power plant	IPCC	%	set at 99.5% (IPCC)
P19 Eff_{HEAT}	Efficiency of methane destruction / oxidation in heat plant	ACM0008 / IPCC	%	set at 99.5% (IPCC)
P23, B19 CEF_{CH4}	Carbon emission factor for combusted methane	ACM0008 / IPCC	t CO_2eq/t CH_4	set at 2.75 t CO_2eq/t CH_4
P28, B18 GWP_{CH4}	Global warming potential of methane	ACM0008 / IPCC	t CO_2eq/t CH_4	set at 21
P8, B49 $CEF_{ELEC,PJ}$	CO_2 emission factor of the grid	National Environmental Investment Agency of Ukraine, NEIA	t CO_2 / MWh	Latest official Ukrainian data have been published at 12/05/2011 at the NEIA website. According to PDD this data is taken into account. Set to: 1.063 t CO_2 / MWh for 2012. [NEIA]
B55 EF_{HEAT}	CO_2 emission factor of fuel used for captive power or heat	National Inventory Report of Anthropogenic Emissions from Sources and Absorption by Absorbers of Greenhouse Gases in Ukraine for 1990-2010	tCO_2/MWh	set to 0.3298 tCO_2/MWh Using the value for “Other Bituminous Coal” of 25.99 t C/TJ, [NEIA-2]
B57 Eff_{COAL}	Energy efficiency of coal fired heat plant	Boiler pass	%	set to 73.5% according to boiler passport
Eff_{CHP}	Power generation efficiency of cogeneration unit	Cogeneration unit pass, GE Jenbacher	%	set to 39% for the 50% load of cogeneration unit according to passport

B.2.2. List of variables:

Table-7 List of variables

ID number	Data variable	Source of data	Data unit	Comment
P1 PE	Project emissions	monitored data	t CO_{2eq}	calculated using formulae (1) from the revised monitoring plan
P2 PE_{ME}	Project emissions from energy use to capture and use methane	monitored data	t CO_{2eq}	calculated using formulae (2) from the revised monitoring plan
P3 PE_{MD}	Project emissions from methane destroyed	monitored data	t CO_{2eq}	calculated using formulae (3) from the revised monitoring plan
P4 PE_{UM}	Project emissions from uncombusted methane	monitored data	t CO_{2eq}	calculated using formulae (9) from the revised monitoring plan
P5 $CONS_{ELEC,PJ}$	Additional electricity consumption by project	electricity meter	MWh	measured
P9 PE_{Flare}	Project emissions from flaring	monitored data	t CO_{2eq}	calculated using formulae (9a) from the revised monitoring plan
P11 MD_{FL}	Methane destroyed by flaring	calculated	t CH_4	calculated using formulae (5) from the revised monitoring plan
P12 MM_{FL}	Methane sent to flare	measured ID's- 10-13	t CH_4	measured
P14 MD_{ELEC}	Methane destroyed by power generation	monitored data	t CH_4	calculated using formulae (7) from the revised monitoring plan
P15 MM_{ELEC}	Methane sent to power generation	monitored data	t CH_4	calculated using formulae (29) from the revised monitoring plan
P17 MD_{HEAT}	Methane destroyed by heat generation	monitored data	t CH_4	calculated using formulae (8) from the revised monitoring plan
P18 MM_{HEAT}	Methane sent to boiler	flow meter	t CH_4	measured
P24 CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (various)	lab analysis	t CO_2 / t NMHC	calculated if applicable
P25 PC_{CH4}	Concentration of methane in extracted gas	IR measurement	%	measured
P26 PC_{NMHC}	NMHC concentration in coal mine gas	lab analysis	%	used to check if more than 1% of emissions and to calculate r
P27 r	Relative proportion of NMHC compared to methane	lab analysis	%	calculated if applicable, based on the lab analysis.

B1 BE	Baseline emissions	monitored data	t CO_{2eq}	calculated using formulae (10) from the revised monitoring plan
B3 BE_{MR}	Baseline emissions from release of methane into the atmosphere that is avoided by the project activity	monitored data	t CO_{2eq}	calculated using formulae (14) from the revised monitoring plan
B4 BE_{Use}	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity	monitored data	t CO_{2eq}	calculated using formulae (24) from the revised monitoring plan
B14 CMM_{PJ}	CMM captured by the project activity	flow meters	t CH_4	measured
B46 GEN	Power generation by project	power meter	MWh	Cumulative value
B47 HEAT	Heat generation by project	heat meter	MWh	measured using steam flow data
T_{Flame}	Flame temperature of the flare	temperature meter	[°C]	measured

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

Table-8 GHG emissions by sources of the project activity

ID number	Data variable	Source of data	Data unit	Comment
P12 MM_{FL}	Methane sent to flare	measured ID's- 10-13	t CH_4	measured
P15 MM_{ELEC}	Methane sent to power generation	monitored data	t CH_4	calculated using formulae (29) from the revised monitoring plan
P18 MM_{HEAT}	Methane sent to boiler	flow meters	t CH_4	measured
P25 PC_{CH4}	Concentration of methane in extracted gas	IR measurement	%	measured
P26 PC_{NMHC}	NMHC concentration in coal mine gas	lab analysis	%	used to check if more than 1% of emissions and to calculate r

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

Table-9 GHG emissions by sources of the baseline

ID number	Data variable	Source of data	Data unit	Comment
B14 CMM_{PJ}	CMM captured by the project activity	flow meter	t CH_4	
B46 GEN	Power generation by project	power meter	MWh	Cumulative value

B47 HEAT	Heat generation by project	heat meter	MWh	measured using steam flow data for boiler and coolant parameters for cogeneration

B.2.5. Data concerning leakage

Not applicable.

B.2.6. Data concerning environmental impacts

The project meets all the ecological requirements and all ecological permissions are present for equipment used in the project. In general all the activities which were performed from the beginning of the project led to the significant reduction of the methane emissions into the atmosphere and now almost all of CMM is utilized at the Central Shaft.

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

The data for the boiler are collected, processed and stored using a Siemens SIMATIC PLC S7 system and Siemens WINCC programming software. All data is stored in the internal memory about 2 GB. One time per hour the data are sent via GPS to an Internet-based Server data base. Eco-Alliance ensures regular backups and archiving. Further on the data is stored and archived by Eco-Alliance.
The data can be read any time from the internet data base by authorised personnel. The utilised methane amount is automatically calculated and stored in the PLC. As all input data are stored, the automatically calculation can by checked in retrospect any time.

For the flare and the cogeneration units Sinapse has provided a system for data collecting, archiving and sending to Internet, called Graphic Data Manager RSG 40 Memograph M. The data is stored in the memory of computer for 6 months. Every month coal mine personnel save the data into flash memory and send it to Eco-Alliance.

For heat generated by boilers the vortex flow meter is used which processes steam temperature, steam pressure and other parameters and shows the value of heat for period of 15 minutes.

The heat power generated by cogeneration station consists of heat given to the consumer (boiler) and consumed for own needs. It’s measured with two heat meters. Microprocessor heat control unit BKT.M converts input information about the parameters of coolant and makes calculations of produced or consumed heat energy based on these amounts in composition of the heat meter of type STS,

For plausibility checks and potential data back up the data logged in the hand written journals of the suction system can be taken.

B.4. Special event log:

The boilerhouse stopped to use methane from 12/11/2012 because of lack of gas amount.

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 Technical Director of the «Colliery Group «Pokrovs'ke» through supervising and coordinating activities of his subordinates, such as the degasification engineer, heating technician, and safety engineering departments.
Daily a group of mechanics and electricians who are responsible for the measures and maintenance of all technological equipment and measuring instruments are present on-site. There are two shifts, 12 h each. For every shift there is one person on-duty responsible for the proper operation and keeping of the journals.
The general supervision of the monitoring system is executed by the administration of the coal mine under the existing control and reporting system.

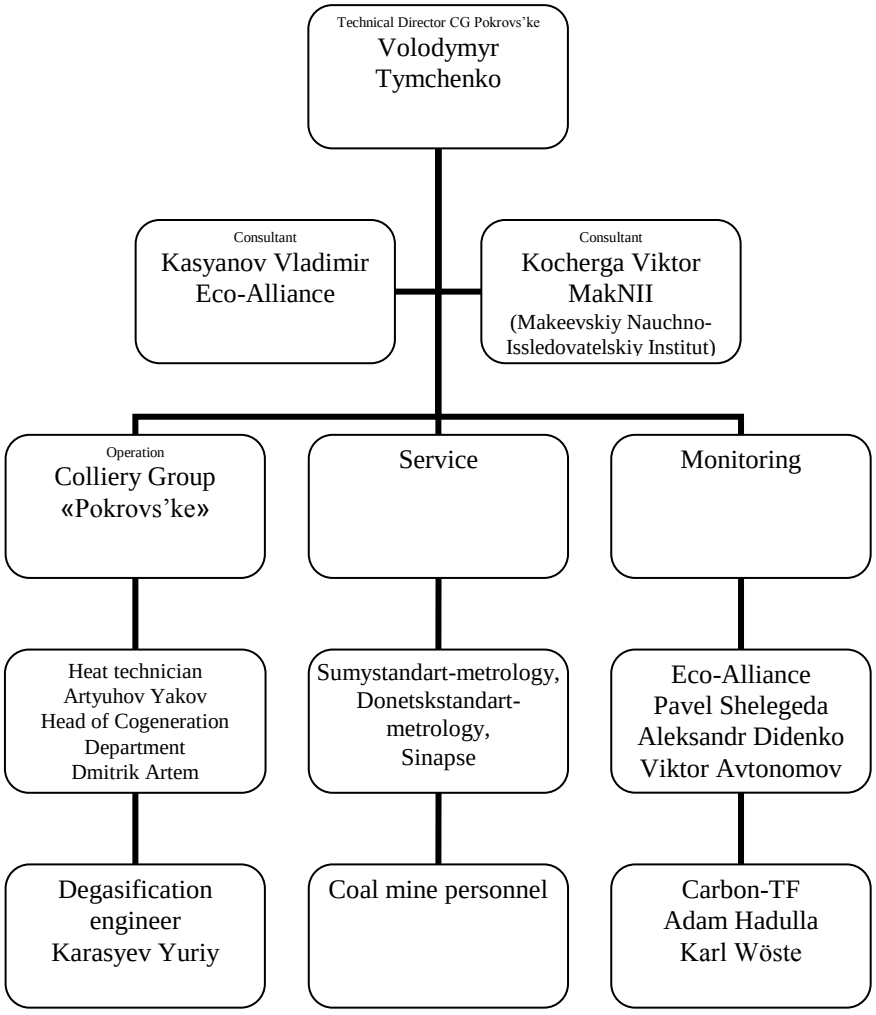


Figure 1 – Organigram

C.1.2. Trainings:

The employees of the boilerhouse responsible for the monitoring control have been trained on–the–job during the installation of the system. The responsible personnel of Eco-Alliance have been trained on the handling with CMM-utilisation units and the applied monitoring systems, during several practical courses in Germany. In this courses which has been carried out by A-TEC Anlagentechnik GmbH, a Joint-Venture participant of Eco-Alliance, also the basic principles of emissions trading and the background of the monitoring has been explained.
A-TEC Anlagentechnik GmbH is already running several CMM utilisation plants and monitoring systems in Germany.
These trained personnel is the basis of a team of engineers, which should establish a specialised service team in the Ukraine and instruct further operating and monitoring personnel, as well for this project.
The personnel of the flare unit and cogeneration units, responsible for monitoring control have been trained on–the–job during the installation of the flare unit, cogeneration units and monitoring system by Sinapse.

C.2. Involvement of Third Parties:

- Sumystandartmetrolology and Donetskstandartmetrolology are subsidiaries of the “Ukrainian Ukrainian Centre for Standardisation and Metrology”, which is part of the “State Committee for Matters of Technical Regulations and Consumer Politics”, which is part of the government, were involved for the regular calibration of the measuring equipment.
- Respirator has been involved for the lab analysis (NHMHC) of the CMM in 2012.
- Eco-Alliance provided the electronically data acquisition system and the monitoring activity together with the coal mine personnel.
- As the provider of flare equipment, cogeneration units and belonging monitoring system, Sinapse performs maintenance and adjustment of the monitoring system.

C.3. Internal audits and control measures:

Every 2 weeks a monitoring engineer from Eco-Alliance makes audits of data (set of parameters taken from the monitoring system screen) which is written in operational journal by boiler staff and remarks that checking was made in the operational journal. The mechanic on duty from the coal mine makes daily audits of registering data from monitoring system screen by boiler staff.

The monitoring engineer (Eco-Alliance) checks the data from web-site (set of parameters registered by monitoring system and transferred to site of Eco-Alliance – “eco-alliance.com.ua”) every day and makes internal weekly reports.

Methane concentration and CMM flow data of the flares are compared with the indication of the meters from the vacuum pump station for plausibility. The coal mine personnel have been instructed by Eco-Alliance.

QM procedure:

For boilerhouse:

- Electronic data are stored at Eco-Alliance and Carbon-TF.
- Back-ups are made regularly by Eco-Alliance and Carbon-TF.
- A monitoring engineer from Eco-Alliance checks the data from web-site every day and makes internal weekly reports.
- Eco Alliance prepares monthly reports which are checked by Carbon-TF B.V.
- Additionally data are recorded manually in journals by the coal mine personnel

- The journals are checked daily by the chief heat technician and cross-checked by Eco Alliance every 2 weeks. Monitoring engineer from Eco-Alliance makes a remark in the operational journal.
- The paper data are stored at the coal mine.
- The mechanic on duty from the coal mine makes daily audits.
- Eco-Alliance makes service audits every month.

For flare and cogeneration units:

- Electronic data are stored in the memory of Graphic Data Manager RSG 40 Memograph.
- Back-ups are made regularly by personnel of the coal mine's Cogeneration Section.
- Data are recorded manually in journals by personnel of the coal mine's Cogeneration Section.
- The journals are checked daily by the engineer of technical diagnostics and cross-checked by the programmers of the Cogeneration Section.
- The paper data are stored at the coal mine.
- Every month personnel of the Cogeneration Section send electronic data from the flare to Eco-Alliance.

General:

- Carbon-TF prepares the monitoring report, which is checked by Eco-Alliance and the coal mine.

C.4. Troubleshooting procedures:

The general troubleshooting for the steam boiler hasn't changed. In case of disturbance the gas supply to the boiler is shut down by a quick acting valve and the CMM supplied by the degasification system of the coal mine is blown to the atmosphere. The flare is also automatically shut down in case of faults.
The procedures are available at the coal mine. The coal mine personnel are instructed to follow the procedures.

SECTION D. Calculation of GHG emission reductions

D.1. Table providing the formulas used:

Table-10 Formulae used taken from the Revised Monitoring Plan

ID number	Data variable	Formula
P1 PE	Project emissions	$PE = PE_{ME} + PE_{MD} + PE_{UM}$
P2 PE_{ME}	Project emissions from energy use to capture and use methane	$PE_{ME} = CONS_{ELEC,PJ} \times CEF_{ELEC,PJ}$
P3 PE_{MD}	Project emissions from methane destroyed	$PE_{MD} = (MD_{FL} + MD_{ELEC} + MD_{HEAT}) \times (CEF_{CH4} + r \times CEF_{NMHC})$
P4 PE_{UM}	Project emissions from uncombusted methane	$PE_{UM} = GWP_{CH4} \times [MM_{ELEC} \times (1 - Eff_{ELEC}) + MM_{HEAT} \times (1 - Eff_{HEAT})] + PE_{Flare}$
P11 MD_{FL}	Methane destroyed by flaring	$MD_{FL} = \sum_{i=1}^{n} MM_{FL,i} \times \eta_{flare,i}$
P14 MD_{ELEC}	Methane destroyed by power generation	$MD_{\mathbf{ELEC}} = MM_{\mathbf{ELEC}} \times Eff_{\mathbf{ELEC}}$
P17 MD_{HEAT}	Methane destroyed by heat generation	$MD_{\mathbf{HEAT}} = MM_{\mathbf{HEAT}} \times Eff_{\mathbf{HEAT}}$
MM_{ELEC}	Methane amount sent to power generation	$MM_{ELEC} = \frac{GEN_{CHP}}{Eff_{CHP} \times HV_{CH4}}$
PE_{Flare}	Project emissions from flaring	$PE_{Flare} = (MM_{Fl} - MD_{Fl}) \times GWP_{CH4}$
P27 r	Relative proportion of NMHC compared to methane	$r = PC_{NMHC} / PC_{CH4}$
B1 BE	Baseline emissions	$BE = BE_{MR} + BE_{Use}$
B3 BE_{MR}	Baseline emissions from release of methane into the atmosphere that is avoided by the project activity	$BE_{MR} = CMM_{PJ} \times GWP_{CH4}$
B4 BE_{Use}	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity	$BE_{Use} = GEN * EF_{ELEC} + (HEAT / Eff_{COAL}) * EF_{HEAT}$
B14 CMM_{PJ}	CMM captured in the project activity	$CMM_{PJ} = (MM_{FL} + MM_{ELEC} + MM_{HEAT})$
ER	Emission reductions	ER = BE - PE
	Gcal into MWh conversion	1 Gcal = 1,163 MWh

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

Some minor errors which have been identified in hand written operation journals have been corrected. Mistakes were made during the writing the data from the monitor into journals.

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

D.3.1. Comparison

Period	**Prospected emission reductions, PDD [t CO_{2eq}]**		**Monitored emission reductions [t CO_{2eq}]**	
	Full year	Proportionally for the monitoring period	In tonnes CO_2eq and percentage of the prospected emission reductions	
01/05/2012 - 31/12/2012	1,781,880 (2012)	1,187,920	235,612	19,8%

The monitored values are significantly lower than the prospected values, because a big part of the project has not been installed until the end of the monitoring period.

D.3.2 Monitored project emissions

Monitored project emissions [t CO_2eq / a]	
period	01/05/2012 - 31/12/2012
methane destruction	
flaring	3,350
heat generation	1,667
power generation	25,719
additional power consumption	
power generation	2,318
Total	**33,054**

D.3.3 Monitored baseline emissions

Monitored baseline emissions [t CO_2eq / a]	
period	01/05/2012 - 31/12/2012
release of methane that is avoided by the project	
flaring	17,693
heat generation	12,321
power generation	190,092
production of heat that is displaced by the project	3,488
production of power that is displaced by the project	45,072
Total	**268,666**

D.3.4 Project emissions, baseline emissions and emission reductions

Year	Monitored project emissions (tonnes of CO_2 equivalent)	Monitored leakage (tonnes of CO_2 equivalent	Monitored baseline emissions (tonnes of CO_2 equivalent)	Monitored emissions reductions (tonnes of CO_2 equivalent)
01/05/2012-31/12/2012	33,054	-	268,666	235,612

Annex 1

REFERENCES

- [PDD] Project Design Document; Version 04, dated 2008-09-10
- Final Determination Report for the project: JI0105 “CMM utilisation on the Joint Stock Company “Coal Company Krasnoarmeyskaya Zapadnaya № 1 Mine””; Report No: 2008-1279 Rev 01, by DNV Det Norske Veritas, dated 2008-08-30
- [LoA] Letter of Approval, Nr. 2239/11/10-08, issued on 2008-02-22 by the Ukraine (host party)
- [LoA] Letter of Approval, Nr. 2008JI02, issued on 2008-04-22 by the Kingdom of the Netherlands (investor party)
- [LoE] Letter of Endorsement, Nr. 973/10/3-10, issued on 2007-02-02 by the Ukrainian Ministry of Environmental Protection
- [RMP] revised monitoring plan, dated 2012-10-12
- [ACM0008] - Approved consolidated baseline methodology ACM0008, Version 03, Sectoral Scope: 8 and 10, EB28
- [AM_Tool_07] Methodological “Tool to determine project emissions from flaring gases containing methane”, EB 28, Meeting report, Annex 13 http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf
- [NEIA] Baseline carbon emission factor for electric power approved in Ukraine, approved by the State Environmental Investments Agency of Ukraine, previously National Environmental Investments Agency of Ukraine: http://www.neia.gov.ua/nature/doccatalog/document?id=127498
- [NEIA-2] Baseline carbon emission factor for other bituminous coal approved in Ukraine: 25,99 t C/TJ (National Inventory Report of Anthropogenic Emissions from Sources and Absorption by Absorbers of Greenhouse Gases in Ukraine for 1990-2010, Table P2.41)
- [IPCC] Intergovernmental Panel on Climate Change, http://www.ipcc.org
- supporting evidence documents provided by the coal mine

Annex 2

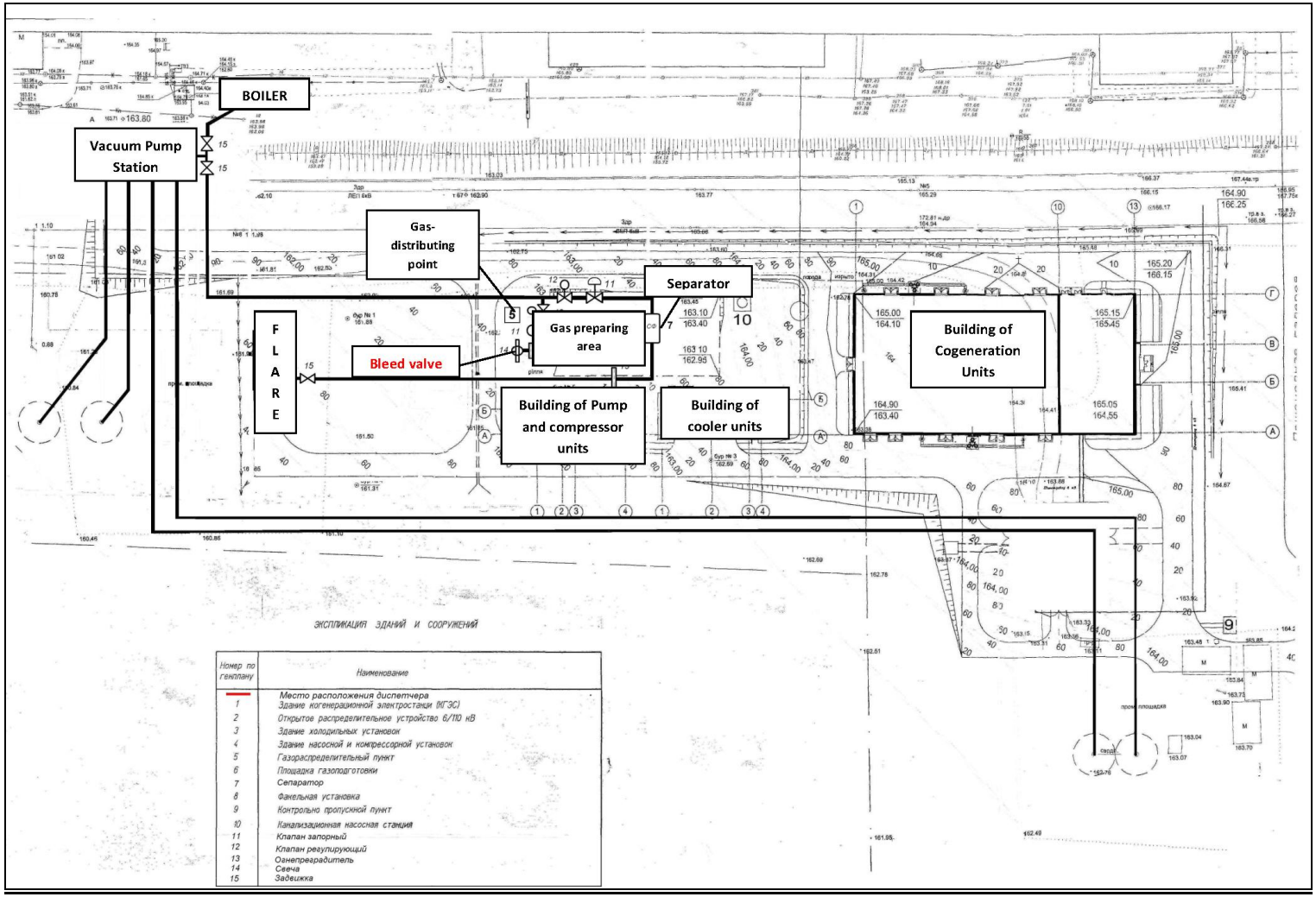


Figure-2 Location Plan – «Colliery Group «Pokrovs'ke», Central Shaft

Annex 3

Energy and material flowchart including metering positions

A3.1 Monitoring plan applied

The electronically measurement procedure, applied since 12/09/2009, is according to the monitoring plan as described in the PDD. A Vortex flow meter instead of a standard orifice as described in the PDD has been used for the measurement of the CMM amount; the flow meters are on par. Manual records (journals) are still used by the coal mine and can be taken for backup.

The CH_4 concentration is measured by a Draeger Politron meter, which is mainly a CH_4 detection and warning system, normally utilised for the determination of dangerous methane concentrations up to the lower explosion limit LEL, for the avoidance of explosions. The analyser is designed and optimized for the exact determination of low methane concentrations. Despite that the range of the meter can be extended to the range of 0-100% CH_4 according to the Draeger manual.
Since October 2010 a new gas analyser manufactured by NUK has been installed in the pipeline to the flare.
Further on a third measurement unit by “Woelke” is installed in the central suction system outside the boiler house. The plausibility measurement (Woelke-measurement unit) is not recorded.

A3.2 Measurement unit installation

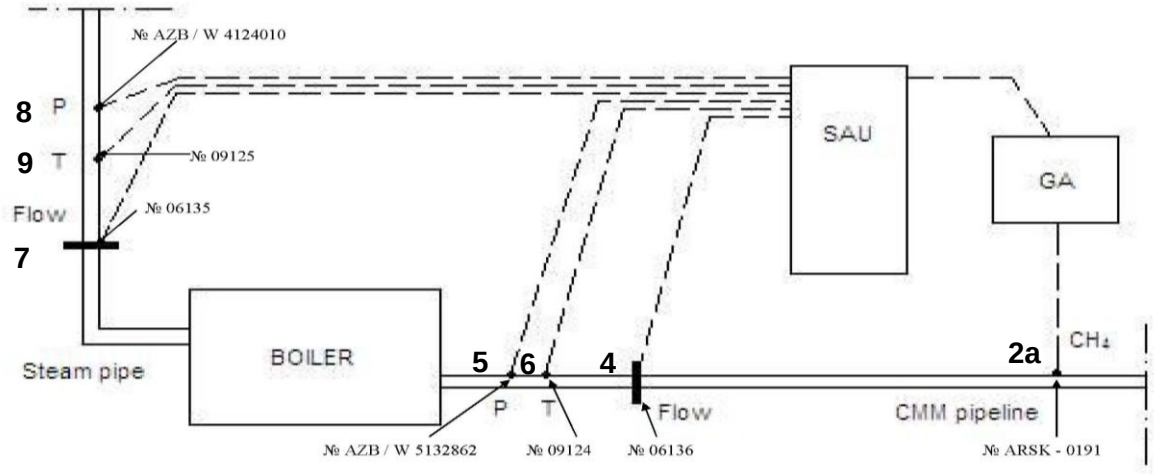


Figure-3 – Installation scheme of the boiler monitoring system
2a) concentration measurement – Draeger Politron
4) CMM flow meter - Vortex
5) CMM pressure
6) CMM temperature
7) steam flow meter - Vortex
9) steam pressure
9) steam temperature

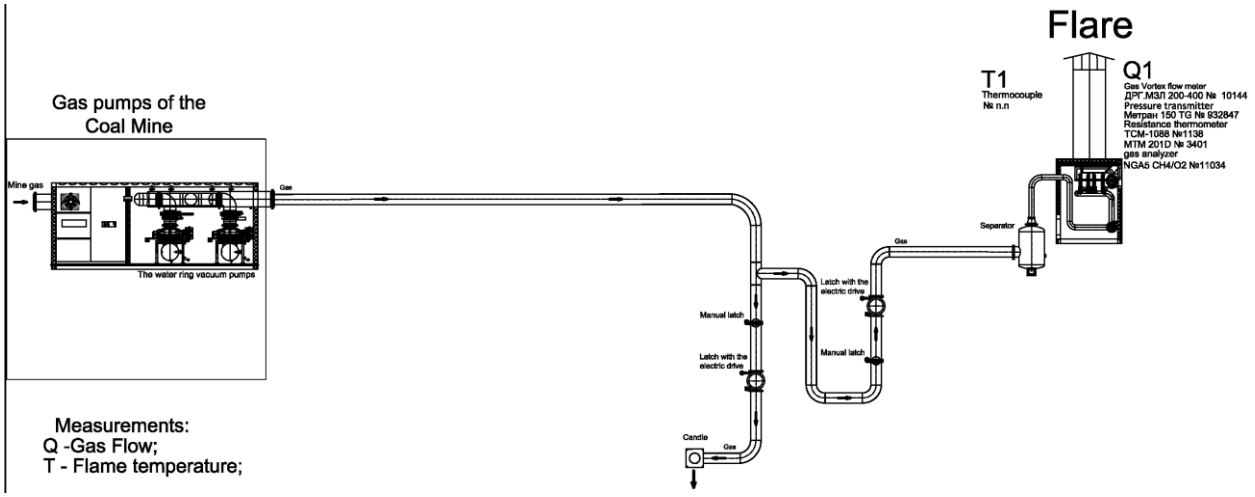
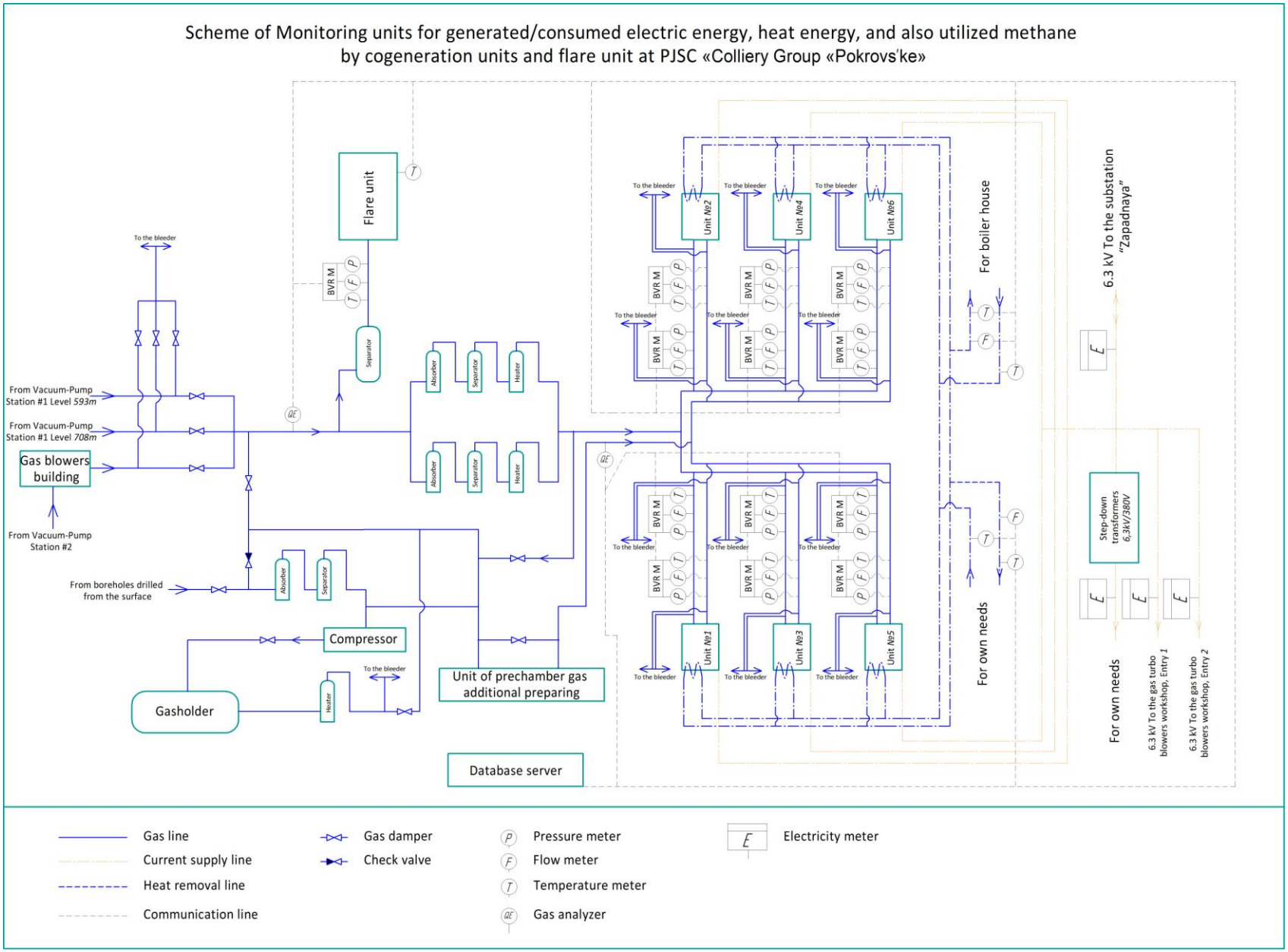


Figure-4 – Installation scheme of the flare monitoring system

Q1) CMM flow meter - Vortex
pressure transmitter – Metran 150 TG2
measuring transformer – MTM-201D
gas analyser - NGA5

T1) Thermocouple – TPP-401M

Figure-5 – Next page - Installation scheme of the monitoring system for cogeneration


Scheme of Monitoring units for generated/consumed electric energy, heat energy, and also utilized methane
by cogeneration units and flare unit at PJSC «Colliery Group «Pokrovs'ke»
Flare unit
To the bleeder
BVR M
Separator
Absorber
Heater
From Vacuum-Pump Station #1 Level 593m
From Vacuum-Pump Station #1 Level 708m
Gas blowers building
From Vacuum-Pump Station #2
From boreholes drilled from the surface
Compressor
Gasholder
Unit of prechamber gas additional preparing
Database server
Unit №2
Unit №4
Unit №6
Unit №1
Unit №3
Unit №5
For boiler house
For own needs
6.3 kV To the substation "Zapadnaya"
Step-down transformers 6,3kV/380V
For own needs
6.3 kV To the gas turbo blowers workshop, Entry 1
6.3 kV To the gas turbo blowers workshop, Entry 2
Gas line
Current supply line
Heat removal line
Communication line
Gas damper
Check valve
Pressure meter
Flow meter
Temperature meter
Gas analyzer
Electricity meter

A3.3 Description of the operating scheme for cogeneration units

At the current stage gas is supplied to the Cogeneration station from the vacuum pump station №1 (VPS №1), the main industrial site of PJSC "Colliery Group" Pokrovs'ke".
Also the construction of additional methane supply from the vacuum pump station № 2 (VPS №2) of the air-supply shaft №2 comes to an end. On this line, gas blowers are installed at gas preparing section for gas flow quality increase.
At the gas preparing section there will be mixing of all gas flows in the correct proportions to obtain the methane concentration not below 25%, and the preparation of gas to the desired condition (pressure, temperature, humidity). Excessive gas or gas with low concentration is discharged to the discharge bleeder of the Cogeneration station or the discharge bleeders of VPS №1 and VPS №2.
After mixture assembly, final methane concentration is measured by gas analyzer NGA-5 and the gas flow is split into two lines:
Line 1 - excess gas not used by the cogeneration modules and the boiler is drained on the flare separator and is fed to the flare HOFGAS-IFL4c 9000 for combustion.
Line 2 - preparation of gas for cogeneration units in accordance with the requirements of Jenbacher. At this stage, the gas is dried and cleaned of impurities by passing through the two chambers of irrigation and cooling (fuel gas absorber), two drying chambers (fuel gas separator), two gas heating chambers (fuel gas heater).
To use cogeneration unit in addition to the main (fuel gas) at a concentration > 25% and pressure of min 100 mbar prechamber gas is also required with a concentration of > 25% and min pressure 2,7 bar. Due to the fact that the required concentration of the main and prechamber gas are more than 25%, the intake of gas required for ignition of prechamber engines is possible as after fuel gas heater, or gas-holder (through heater), or from boreholes drilled from the surface (through absorber and the prechamber gas heater (supply line to the Cogeneration station was not performed)).
The required pressure of prechamber gas is reached in the block of additional prechamber gas preparation (in the case of using prechamber gas from the gas holder block of additional prechamber gas preparation is not used).
To ensure the safe operation of cogeneration units, discharge bleeders are installed before register points (sets of measurement equipment for gathering information from meters), as well as after register points before enter to engine of main and prechamber gases. They are used to purge possible explosive mixture after gas systems repairs.
To register power consumed for own needs the electricity meter installed on the line after own needs transformer 6kV/380V is used. To register power consumed by the gas blowers, two electric meters will be installed at the supply inputs of gas blowers №1 and №2.
The generated heat power consists of heat given to the consumer (boiler) and consumed for own needs. Calculation of the heat power is performed by two liquid flow sensors and four temperature sensors.
Register points of the main and prechamber gas are installed before each module. The composition of each point consists of flow sensor, temperature sensor and pressure sensor, and the computing block, which registers utilized methane accumulation. The concentration of prechamber methane gas will be measured before enter into the engine room after the prechamber gas preparation block.
RSLinx Enterprise software of the Rockwell Automation production makes the collection and archiving of the following parameters from the register points and equipment:
- from the computing units - the current flow rate, temperature, pressure and cumulative flow of the methane-air mixture;
- from the gas analyzers of main and prechamber gases - methane and oxygen concentration;
- from the flare - the temperature of the gas combustion;
- from electricity meters - the accumulation of the generated / consumed energy.

At the same time accumulating data (power, heat, gas mixture and pure methane) are written to the database in the form in which they were at the time of register. The remaining data are averaged for the recording interval, which is 15 minutes.

Annex 4

History of the Document

Version	Date	Nature of Revision
1	17 December 2012	Initial adoption
2	23 January	December data included
3	21 March	Revised version
4	24 April	Revised version